EXHIBITS 1-6

EXHIBIT 1

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION

IN RE LITHIUM ION BATTERIES) Case No.
ANTITRUST LITIGATION,) 13-MD-2420-YGR
______________________________) (DMR)
)
)
This Document Relates to)
)
INDIRECT PURCHASER ACTION)
______________________________)

VIDEO DEPOSITION OF
EDWARD E. LEAMER, PH.D.
Los Angeles, California
Tuesday, April 26, 2016

Reported by:
LISA MOSKOWITZ, CSR 10816, RPR, CRR, CLR,
NCRA Realtime Systems Administrator
JOB NO. 106708

So my question is very simple. Have you done any analysis where you excluded the data from what we're calling the bump period and looked at what your regression then shows with respect to the overcharge for all the periods -- you can put them all together. It doesn't matter, either separately or together, all the periods other than the bump data, whether that is statistically significant or not? Have you done that work?

A. The answer to your question is embodied in the equation that you see in front of you if you'll let me explain why.

Q. Okay. Go ahead.

A. This equation has two binary indicators. One is a binary indicator that refers to the complete period in which the conspiracy was operative between January of 2000 and ending April, 2011.

It includes also another indicator that identifies the period that this attorney is worried about, namely April, 2007, to December, 2009. So it lets the level of the conspiracy effect be entirely

recommendation. Okay. So it is your --
MR. GLACKIN: You did tell him you were going to let him explain his answer after he --
MR. KESSLER: But he answered it now. He said it's 10 percent --
MR. GLACKIN: Please finish your answer.
MR. KESSLER: I can move to the next question.
You need to stop interrupting him, Mr. Kessler. Please let him finish answering the question.
BY MR. KESSLER:
Q. Answer the question, please.
A. I think the court needs to know that there's uncertainty in the damage estimate. That the best damage estimate embodied in this coefficient is .004. It could be twice as big, or it could be zero. There's a range like that, that the data are compatible with. That's the best way. Then the court has to make a judgment as to what damages are we going to award when we have this level of statistical uncertainty. But

the idea that courts should slavishly use a particular P value or particular significance level, that's highly unwise.

So I'm going to convey exactly the information you want, exactly the same information. It just comes in a different package. You're upset by the package, but I think my package is better than yours.

Q. I'm not upset at all. All I want to do is establish what you are agreeing. So you agree with me that the level of statistical significance that you found inappropriate to apply, to the extent it's appropriate at all -- I understand you may feel it is better to not apply any test slavishly, as you said. But to the extent that you've applied one over protest because you don't like it, it's the 10 percent level?

MR. GLACKIN: Object to the form. It's argumentative.

THE WITNESS: Those asterisks serve the purpose of identifying which coefficients achieve particular significance levels. And they're a

clear. That's all.

So talking about this. And we've already discussed some of this already because we already went through Figure 46. I'd now like to go through the specific companies. So look at page 87.

How were these OEMs of LIB products chosen? Who decided that you would do AO open, okay, as opposed to Lenovo or that you would use Dell as opposed to HP? In other words, did you make any decisions in shaping, you know, which particular companies would be chosen -- or describe how it got to be these particular companies?

A. I had no input into this process.

Q. Okay. It was all done by the attorneys and they just delivered to you the data and said here it is?

A. Well, the attorneys and the Econ One consulting firm.

Q. But Econ One did not consult with you on how to do this?

A. Well, we talked about how these -- the datasets were slowly being produced and how difficult they were to work with and how

we needed more, and we had those kind of conversations.

Q. I guess I wasn't following --

A. I assumed the Econ One personnel would communicate to the attorneys about the usefulness or not of some of these datasets.

Q. Did you give any directions to Econ One as to what type of data -- which companies they should pick or not pick or anything like that?

A. More is better.

Q. Other than you would love endless data, other than infinite data is good, other than that question, between one company or another, did you give any guidance to Econ One or to the lawyers or anybody?

A. No, I did not.

Q. Okay. And would the same be true on page 90 with respect to the lithium ion battery product distributors, you did not give any guidance and direction as to which distributors should be used as opposed to any other distributor of these products?

A. That's correct.

Q. And the same would be true of the retailers starting on page 91. You didn't give any guidance as to which particular retailer would be used? Like, for example, do you know why Best Buy was used but not Circuit City?

A. Well, I think availability of the information was a critical step here. But I was not involved in the design of the subpoenas.

Q. Isn't Circuit City data produced in this case?

A. I don't know.

Q. Okay. Do you know if Circuit City was ever a plaintiff in this case?

A. Not off the top of my head, no.

Q. If there -- do you know if Circuit City data was produced in the LCD case?

A. I don't recollect.

Q. Do you know if the data available from the LCD case could be available to you in this case?

A. I don't recall. I don't know.

Q. Okay. If you had Circuit City data available, would you want to utilize it?

the measurement errors are not with regard to cost that you're referring to but rather with regard to price. That's a relatively benign kind of measurement error which makes it more noisy but doesn't necessarily introduce bias.

Q. Okay.

A. So I've thought about this from an econometric standpoint; so we've got a noisy dataset, and it doesn't add up to a whole lot of concern from my perspective for that reason.

Q. I'm going to come back to that in a second.

You would agree, then, that you could introduce bias if there were missed rebates and discounts and other things in the cost in the product acquisition data; right?

MR. GLACKIN: Object to the form.

THE WITNESS: I think there was -- yeah. You really need to get that cost right.

BY MR. KESSLER:

Q. Okay. Have you done any

UNITED STATES DISTRICT COURT
NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION

IN RE: LITHIUM ION)
BATTERIES ANTITRUST) CASE NO.
LITIGATION,) 13-MD-2420-YGR (DMR)
______________________________) Volume III
THIS DOCUMENT RELATES TO) Pages 527 - 783
INDIRECT PURCHASER ACTION)
)

VIDEOTAPED DEPOSITION OF EDWARD E. LEAMER, PH.D.
Los Angeles, California
Tuesday, October 10, 2017

Job No. 131759
Reported by: NIKKI ROY
CSR No. 3052

Q. Okay.

A. May I add that the hypothetical that you've talked about eliminates the need for a fixed effects because we're talking about only products that are destined to be replacement batteries. So the worst thing that could be -- not worst, but the one interpretation is what we have is pass-through for replacement batteries.

Q. Yes, which may you may not be able to draw any conclusions about the vast majority of the class who purchased actual computers. But, okay, that's -- I withdraw. Let's -- we'll move on. We have a lot of ground to cover.

Okay. Let's move on now to rebates and discounts and bundling. Now, in your report. I believe that study is -- begins in point 3, as reported in point 3, beginning on page 21; is that correct?

A. Paragraph 33 on page 21 is where it begins.

Q. Okay. First of all, it's correct, isn't it, that you did not utilize all the rebate and discount data that you had available to you from the discovery in this case to do your new analyses; is that correct?

A. I -- if there -- if anything is excluded,

there must be a logic for the exclusion. I have no -- I gave no suggestion that should -- there should be any selection on a part of the consultants who are doing this work.

Q. Okay. I'll represent to you that Dell contained extensive rebate data in the data that you had available.

Do you have any idea why you didn't utilize the rebate data available from Dell in your new work?

A. So there's a distinction between mail-in rebates and instant rebates. The data analysis I worked with is instant rebates. The mail-in rebates in the business records typically have a problem because the retailer will sell the product -- well, there's no typically no evidence in the retail data set that the rebate -- the mail-in rebate has occurred.

You have the price that was sold, and the cost that was -- that occurred.

Q. Okay.

A. So to the extent that Dell had mail-in rebates, we wouldn't have been able to work with that data.

Q. Okay. Do you know that you made a determination -- you looked at the Dell data, and

that you found the Dell data on rebates, which is quite extensive, was not usable by you?

A. That -- that would be my understanding. I've had many, many conversations with the consultants who are working about -- on this to determine what we could work with and what we couldn't and I can't recall this specific one.

Q. Okay. How about HP? There was extensive rebate date -- data approved -- produced in this case by HP.

Do you know why you didn't use any of that rebate data?

A. Same answer. That it isn't suited to the kinds of data analysis that are occurring in this section.

Q. Well, that's an assumption you're making. You don't actually know if that was determined or not, right?

A. Well, that -- that -- that statement comes from the conversations that I've had with the folks at Econ One. I can't guarantee that -- that this was carried out according to those wishes, but that certainly would be my wished.

Q. You don't know if -- you don't know if Econ One ran the Dell data and the HP data, found

miserable results for plaintiffs and therefore kept that from you; do you know that one way or the other?

MR. GLACKIN: Objection; argumentative.

THE WITNESS: I highly doubt that. I -- this is not the way I operate. It's not the way they operate.

BY MR. KESSLER:

Q. Okay. How about BrandsMart? Do you know why the rebate data wasn't used for BrandsMart that was produced?

A. Same answer.

Q. Okay. Now, the rebate data that you utilized -- if you take a look at it -- let's go first to Figure 8.

Figure 8 includes rebate data for three retailers: Insight, CompuCom and Zones, correct?

A. That's correct.

Q. Okay. Do any of those does, Insight CompuCom or Zones, did they sell power tools? Do you know?

A. I don't know off the top of my head.

Q. Okay. Do you know if Insight, Zones and CompuCom primarily do B-to-B business as opposed to retail consumer business?

A. That could be. I don't have direct

MR. GLACKIN: Well, he's trying -- I'm trying to do this -- we're trying to do this in an orderly fashion. If you want do it in a disorderly fashion, you go right ahead.

MR. KESSLER: I wanted to make my record. I made my record. Thank you.

BY MR. KESSLER:

Q. Going on now to focal point pricing quality adjustment, okay. As I understand what your theory is for quality adjustment is that for those consumers who did not experience any price impact from the alleged conspiracy because of focal point pricing, you believe that they experienced a loss of quality because the manufacturer would change or the retailer would change the quality mix of products to account for the lower price; is that correct?

A. That's correct.

Q. Okay. Now, have you done any analysis to determine, okay, which consumers in the class experienced a price effect directly and which ones experienced a quality effect?

A. I've not made any attempt to separate the consumers into those two subsets. My expectation would be that the quality effect is going to spread beyond the focal point. So it's not just the sales

at the focal points that have a price, have a quality impact.

Q. Okay. I guess my question is: You haven't offered any methodology for measuring what is the quality effect on specific members of the class, correct, in terms of how much damages they incurred because of a quality reduction as opposed to a price impact?

A. That's correct.

Q. Okay. Second, have you examined at all -- no. Let me do it this way.

Take a look at Appendix B of your report, page 70. These are the lists of the technical features of a notebook PC. Am I correct that the reason you have this appendix is to illustrate the type of quality features which could be changed to cause a quality reduction where a consumer does not have a price impact? Is that the reason for this appendix?

A. Well --

MR. GLACKIN: Object to the form; compound.

THE WITNESS: This -- this appendix is a description of the features that are displayed in Figure 21 and 23 for HP laptops and for Acer laptops.

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I'm just asking, do you have any study in your report that says that the one variable is changes in the price of the battery pack and the other thing you -- variable you're looking at is changes in the quality of the product. You do that analysis anywhere.

A. Can I continue now?

Q. Yeah.

A. Thank you.

This is a set of products whose total costs are fairly constant over time. This is an interval of time, which we know the battery prices are declining, both in the actual world and the but-for world. So the battery price decline is embedded in these images. These product designs that you're seeing are taking advantage of whatever battery price declines are occurring. So there it is, right in front of you.

Q. Have you done any comparison of the but-for world and the actual world as to what were the specific reductions in quality that occurred as a result of the overcharge your model says occurred in the actual world, over the but-for world?

A. I think that exercise would be rather hard to carry out and I've not done it.

Q. Okay. And you're not offering any

methodology for doing it, correct?
A. Well, that depends on data sets, not methodology. If we had all the relevant data sets, we could carry out that kind of work.
Q. Okay. But you don't have such sets. You haven't done it?
A. We have what the defendants have provided.
Q. Okay. But you don't have adequate data to do such an analysis now, correct?
A. That's correct.
Q. Okay. And in your report you don't describe any methodology for doing that, correct?
I'm Just asking if you've done it, not whether you could. Is it in the report?
A. You want to know the actual features that are changed in a but-for world? Is that what you're going for --
Q. Yes. So I'm the consumer who bought at the focal price with no impact. Has there been any study to show what I didn't get? I didn't get RAM. I didn't get -- what didn't I not get? Anything like that? Did you do that?
A. No, I did not do that.
Q. Okay. Now, do you agree with me that different consumers may attribute different values to

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA

OAKLAND DIVISION

IN RE LITHIUM ION BATTERIES ANTITRUST LITIGATION,	Case No. 4:13-MD-2420-YGR (DMR)
This Document Relates to ALL ACTIONS	Volume IV
	Pages 784-978

VIDEOTAPED DEPOSITION OF EDWARD E. LEAMER, PH.D.

Los Angeles, California

Friday, July 13, 2018

Reported By:

SUSAN A. SULLIVAN, CSR #3522, RPR, CRR

Job No. 144529

but for now I'm just going to accept a copy of it and I may mark it later in the deposition --

MR. GLACKIN: That's fine.

MR. KESSLER: -- in terms of that.

MR. GLACKIN: I would suggest that do whatever you can do on it today and if there are issues that arise after today we will deal with them after today rather than arguing about them in the hypothetical.

MR. KESSLER: So let me then ask the question again.

Q Other than what's contained in your May 25th report and in your June 29th report and in the paper that's just been handed to me called Dell Pack Cost Pass-Through, you haven't done any additional work beyond what was in your prior four reports; is that correct?

A That's correct.

Q Okay. Now with respect to this, and maybe I can take it one by one, your methodology for measuring pass-through -- your methodology for measuring pass-through is the same, correct, as in your prior reports; you don't have a new methodology for measuring pass-through, correct?

A That's correct.

Q Okay. And your methodology for estimating the amount of the overcharge is the same as in your prior four reports, correct?
A This report explores the possibility that there's a delay between the battery overcharge and the damage that's suffered by the final customer. That's something we hadn't done before.
Q You take your prior methodology and run it also with a three-month delay; is that correct?
A But -- yes, that's correct, but the three-month a delay is determined by the dataset in a specific way which is a new method that we did here.
Q So the three-month method of using your prior methodology is new to this report.
A That's correct.
Q Other than that, is there any other change to your overcharge methodology from your prior four reports?
A I don't think so.
Q Okay. Now let me ask you just another question. I know that in your reply report, so this is the June report 2628, in Footnote 41, this is on Page 16, you state for the first time here that you were asked to calculate class-wide damages and

purchasers.

MR. KESSLER: Okay.

THE WITNESS: So there's a coordinating mechanism that's going on behind that makes that average applicable to each and every purchase.

Q BY MR. KESSLER: Okay. But you don't know what the actual overcharges were for any individual transaction, correct? Your model doesn't give you a data point for on this sale let's say to this packer, you don't know what the specific overcharge is on a month for that specific sale, correct? You have the average of the whole month of all transactions?

A I know some things about that.

Q Well, do you know the exact overcharge of any particular transaction?

A I do not know the exact overcharge but I know that all these transactions occurred within the same market setting and they're going to be influenced all in a similar way.

Q How do you know that some customers didn't have greater, some packer customers, for example, didn't have greater bargaining power to experience less of an overcharge than a customer with weaker bargaining power in the same month? That's a

bit.
MR. GLACKIN: I'm sorry to interrupt. I lost my realtime.
THE VIDEOGRAPHER: Off video at 8:34 a.m.
(Recess taken)
THE VIDEOGRAPHER: Back on video at 8:36 a.m.
BY MR. KESSLER:
Q Okay. The last questions I asked you, Dr. Leamer, were about whether you had done overcharge studies for each of the direct purchasers. I'm sorry, whether you had done pass-through studies for each of the direct purchasers and you said no, you had not, only the ones you had datasets for.
It is also true you haven't done individual overcharge studies for each of the direct purchasers of the cells at issue, correct?
A That's correct.
Q Okay. Now let me ask you this. Do you know what ODMs are?
A I have some familiarity with that word, yes.
Q What is an ODM?
A My understanding is that the design comes from the OEM and the ODM carries out the manufacturing.

Q BY MR. KESSLER: Do you know what percentage of the market is involved?

A I don't off the top of my head. It wouldn't surprise me if that number was embedded in one of these documents somewhere.

Q Okay.

A But off the top of my head I don't know.

Q Do you know that it is a very significant percentage of the market?

A Off the top of my head I don't know the answer to that.

Q Okay. For example, you know of Dell and HP, correct?

A That's correct.

Q Do you know if Dell and HP actually contract with any of the ODMs for some of the products at issue in this case?

A I would not be surprised if they did but this is not something I pursued.

Q Okay. Do you know if Intel or -- strike Intel.

Do you know if any of the other laptop companies like Lenovo contracted with any of the ODMs in this case?

A Again, I don't know that off the top of my

head but the record may involve some of these reports that I have provided already.

Q Okay.

A Could perhaps include that number.

Q Now do you understand that in an ODM transaction it would be the ODM who would be the purchaser of either a lithium ion battery or a battery pack and then would be incorporating that product into another product that it would be manufacturing for the OEMs like a Dell or an HP or someone like that? Do you understand that's the way the transaction would work?

MR. GLACKIN: Object to the form, assumes facts.

THE WITNESS: That's my understanding.

Q BY MR. KESSLER: Okay. Now it is correct, is it not, that you have not studied a single ODM transaction with respect to measuring to detect whether there was pass-through?

A We studied the OEMs pass-through with regard to those and they're operating in the same environment and would argue that there was evidence about the ODMs from the OEM behavior.

Q Is it correct you have not looked at any data of purchases or sales by any ODM throughout the

entire class period that you studied?
A We didn't get access to that dataset and the answer is yes.
Q And therefore you did not do a single pass-through analysis of any ODM, correct?
A We can't do a pass-through analysis without the data, that's correct.
Q Do you know if counsel for Plaintiffs made any effort to try to seek discovery from any ODMs in this case?
A I don't know that specifically but I'd be surprised if there were no effort in that regard.
Q In any event, you were not given any data for ODMs so you never looked at any ODM data, correct?
A Without data there's nothing to look at, that's correct.
Q Okay. So it is correct, is it not, that you are simply assuming that there would be a pass-through of any overcharge by an ODM based on your theories about the marketplace but you haven't done any actual analysis of ODMs to offer that opinion based on actual ODM data, correct?
MR. GLACKIN: Objection; vague, compound.
THE WITNESS: I spent years studying

Ames who bought in November 2008 has a dollar 53 overcharge and Bradley Van Patten who purchased the notebook in 10/7/2008 has a dollar 41 and the one that you referred to before was Bradley Seldin which is also 2008, was a dollar 53. That's exactly what you asked me before which is that in that cobalt period there were elevated prices but these are all very similar. My point is they're very similar and they're not exactly the same because they're not adjacent months. If you looked at adjacent months you would see a very smooth change in the battery overcharge.

Q Okay. The difference between .09 and a dollar 53 is more than 15 times difference, correct?

A I don't know what you are trying to achieve rhetorically but again the --

Q I just want a math answer. Is it more than 15 times?

A One was in 2006, the other one was two years later in 2008.

Q And it is more than 15 times different?

A Yes.

Q Okay.

I am correct, am I not, that in looking at these individual plaintiffs you didn't calculate,

you didn't examine what the pass-through was in particular for the specific purchase of any plaintiff, correct?

MR. GLACKIN: Object to the form.

THE WITNESS: Well, in order to do that we'd have to know the supply chain through which the battery passed and there's no information with regard to that supply chain and that doesn't allow us therefor to carry out the exercise that you describe.

Q BY MR. KESSLER: So you couldn't do it so you didn't do it, right?

MR. GLACKIN: Object to the form.

THE WITNESS: I assume that's a rhetorical question.

Q BY MR. KESSLER: No, I'd like to get an answer. The answer is yes, you did do it, right?

A No, you said you didn't -- you couldn't do it so you didn't do it.

Q Right. Okay.

A And who could deny that statement.

Q All right. So I will ask it without the first part.

You didn't do such an analysis, right?

A No, I did not.

Q Okay. Now let's go through the list of plaintiffs if we can. So one of the plaintiffs who you --

A Excuse me. Where are you looking, what --

Q You can look at yours which is fine.

MR. GLACKIN: Is there a list you want him to look at?

Q BY MR. KESSLER: Look at your -- look at your -- why don't we -- you have a -- why don't we look at your list, your May 25th list that will serve for this so we can look back at Figure 24.

MR. GLACKIN: So the same one we have been looking at.

MR. KESSLER: Yes, let's look at the same one, okay?

THE WITNESS: I have Page 60.

Q BY MR. KESSLER: Let's look at Page 57, "Plaintiffs' Damages," okay?

So let's start first with the first plaintiff listed. And with respect to that plaintiff, okay, do you know whether or not that plaintiff purchased in a bundled purchase?

A Well, now you are asking me knowledge of the whole record which I don't have at the top of my head.

Q Well, let me put it this way.

If this plaintiff did purchase in a bundled purchase you didn't study that purchase in order to calculate whether this plaintiff suffered pass-through injury or not or how much?

MR. GLACKIN: Object to the form.

THE WITNESS: Well, in one of these earlier reports that you referred to before we did have studies of the bundling effect.

Q BY MR. KESSLER: That's not my question.

A Not here.

Q My question is you studied the specific bundled purchase of this individual plaintiff.

A The prior reports found that the phenomenon of bundling doesn't alter the pass-through; that sellers are still worried about cost and trying to get the highest price they can given the cost, so it doesn't change the basic behavior of the firms because they offer to bundle product.

Q Did you look in your individual damage analysis whether or not this plaintiff bought in a bundle and what price he paid for the bundle and what products were in the bundle? Yes or no, please.

MR. GLACKIN: Object to the form, compound.

THE WITNESS: Again, the -- I know something about the bundling effect based on the work that I did earlier and therefore came to the conclusion that I didn't have to know whether this one was bundled and another one was not.

Q BY MR. KESSLER: So you do not study the specific bundled purchase at this point. I will represent to you was a bundled purchase. You didn't study the specifics of that bundled purchase, correct?

A The fact that it was a bundled purchase has no implications for the damages and therefore was not pursued.

Q Okay. Did you study the specific sales transaction; for example, do you know whether or not this person purchased from a retailer or purchased from an OEM or purchased some other way?

A Well, the record I'm sure you are familiar with, the depositions, will sometimes indicate, have an answer to that question. I don't know specifically with regard to this individual.

Q Okay. Did you do a pass-through study for the specific OEM who sold to the, who created the product that this person purchased?

A Well, I did some OEM pass-through work which

I'm sure you are aware, but I do not know if the OEM through which this individual purchased the product, produced the product, I don't know whether that's in the OEM pass-through analyses that I carried out.

Q Let's go to Appendix B of your -- which lists details on Plaintiffs' purchases.

Okay. This was -- the purchase was listed here according to you, a Dell Studio 15 laptop, do you see that?

A Yes, I do.

Q Okay. Did you do any specific study of pass-through for the Dell Studio 15 laptop in 2009 in any of your pass-through studies?

A No, I did not do anything specific to that particular transaction or that are particular item.

Q Or that -- you didn't do that item at all for Dell that year, correct, on pass-through?

A That's correct.

Q Okay. Looking down to the next plaintiff on this list, the Dell Inspiron 15 that was purchased in 2005, did you do any specific pass-through study of that model?

A Well, I want to emphasize in my answer the use of your word "specific" because I carried out a lot of pass-through studies that have implications

for the pass-through for this item but I have not studied this particular item and the pass-through that assigns to it.

Q Okay. Did you ever study the next one for Shawn, the pass-through regarding the Dell Inspiron 1505 in 2006? Did you do any pass-through study of that?

A Same answer.

Q Okay. For the next plaintiff, for the Makta Cordless drill, did you do any pass-through study of any products by that manufacturer at all, even one of any year of any type?

A By the way, it says Makita.

Q Makita, sorry. It is hard to read it.

Did you do any pass-through studies of Makita products?

A I did it on drills but -- and Makita products were probably part of that.

Q Do you know if you did a study --

A I don't know sitting here today everything I have done because you must be aware of the massive amount of work that's gone into these six different reports.

Q Am I correct that you did not in doing your damage analysis for any of these plaintiffs attempt

to calculate a specific pass-through regarding the specific product that a particular plaintiff purchased?

A Well, the premise when you use the word "attempt" suggests that this is possible and I want the record to show that I do not have the datasets that would allow me to do that, what you are calling an attempt.

Q Okay. Why was it not possible, for example, to get a dataset from Dell who was located in this country that would enable you to do a pass-through study of the specific models purchased by those plaintiffs? Why is that an impossibility?

A You are talking about the specific Inspiron 6000?

Q Yes. Whether it is the 6000 or the 1505 or any of these specific Dell products, why was it not possible for you to get a dataset to do a pass-through study of the specific products purchased, the Dell products purchased by these plaintiffs?

A Well, the defect of these datasets in terms of studying cost pass-through is the time periods in which these items sit on a shelf. It is typically quite short, maybe three months, and that makes it very hard to estimate the kind of dynamic pass-

through model that I've estimated using the average costs and average prices across many models.

Q You did one OEM pass-through study for one Sony product, correct, that's in your reply report?

A I think that's correct.

Q Okay. So if you could do that for one Sony product, why didn't you do such a study for the specific Sony products purchased for any of the plaintiffs in this case?

MR. GLACKIN: Object to form.

THE WITNESS: Can we refer to the -- where that Sony product is?

Q BY MR. KESSLER: Sure. Take a look at your reply report. Let me see if I can find it. It may also be in your main report as well, actually, now that I'm thinking about it.

Is this the reply or the main?

MR. AMATO: Reply.

MR. GLACKIN: It is 51 in the main report.

MR. KESSLER: The reply, it is on Page 12.

Q You see you did a Sony camcorder battery cost pass-through here?

A That's a camcorder, that's not a specific item.

Q Isn't that a specific Sony camcorder?

OEM pass-through like that are of the Toshiba notebooks and then more recently the Sony camcorder batteries? You don't recall that as you are sitting here?

MR. GLACKIN: I'm going to object to the question as vague and ambiguous.

I could suggest to you how you could clarify this to get through it.

THE WITNESS: Again, I would like to take a look at that document so I could refresh my memory rather than having a memory test here.

MR. KESSLER: Okay. I will come back to it after a break, okay? We'll move on now. Okay.

Q Am I correct that you did not attempt in your individual plaintiffs' damage analysis or pass-through analysis to do a pass-through study for the specific retailers at which individual plaintiffs may have purchased their products?

MR. GLACKIN: Object to the form.

THE WITNESS: Well, again, I did a variety of retailers and some of those retailers would be on this list of suppliers to the named plaintiffs so the answer is in part yes and in part no.

Q BY MR. KESSLER: Okay. You didn't calculate any separate retailer-by-retailer overcharge rate to

apply to the plaintiffs, correct? You applied the same hundred percent or 136% overcharge to each of the plaintiffs' damages, right?

MR. GLACKIN: Objection; compound.

THE WITNESS: I used -- for calculating damages I looked at two -- two pass-through rates, a hundred percent and 136%.

Q BY MR. KESSLER: Right. So if a retailer you looked at had a rate let's say of 50% and that plaintiff purchased from that retailer you still wouldn't apply the 50% rate you would have calculated in my hypothetical, you would apply the uniform 100% rate, 100 and -- what is it, 100 and -- what's the --

MR. GLACKIN: 36.

Q BY MR. KESSLER: Yes. 136% rate, right?

You didn't vary it if you had a retailer study that showed a different rate?

A I'm not sure what hypothetical you have in mind when you say it is a 50% pass-through.

Q Isn't it correct that some of your retailer studies showed pass-through rates less than a hundred percent?

A That could be but, remember, the way of summarizing it isn't to cherry-pick with regard to

carried out my damage analysis. And you can see the AOpen is completely compatible with the wide range including the hundred percent pass-through rate.

Q Okay.

A Acer is -- looks like it is the data like to have a little higher pass-through rate but not so much more than one, 1.11; Dell a little bit higher, Fujitsu is a little higher, Sony only 1.02 is the minimum. So this is suggestive of a somewhat higher pass-through rate than a hundred percent and I have carried out the exercise to give you the damages with a hundred percent pass-through and 136% pass-through.

Q Okay.

A The 136% is sort of a summary of all these intervals that we have, although compounded across the different parts of the distribution chain. OEM, distributor and retailer are studied separately.

Q I'm correct, am I not, that to get the ultimate pass-through rate to a purchaser from a retailer you have to multiply the OEM rate times a distributor rate if it was through a distributor times a retailer rate to come up to what the ultimate pass-through would be to that purchaser, correct?

MR. GLACKIN: Object to the form.
Q BY MR. KESSLER: Because it has to pass through each level of the chain.
A I agree. I was just thinking about the timing.
We've carried out the exercise that allows to us say on average there's a three-month delay and you are asking me whether the -- you know, it would be the product. So if it is 100% of each level, then it would be 100% over all.
Q Okay. Right.
So use just the numbers that you have here, okay, and if it was .61 at one level and it went through a distributor at .89 and it went through a retailer at .81, then the way I would come up with my pass-through rate for a plaintiff there would be to multiply .61 times .89 times .81, correct?
A That's not correct and for the following reason. You are picking specific items in here and if you did the estimation correctly you would think of these things as coming from similar processes and therefore you would shrink all of these together to some extent so what you've carried out is an exercise that ignores all the other regressions and focuses on one OEM, one distributor and one retailer

and the proper statistical analysis would be to embed each one of those in the setting which this data came from and therefore to make the pass-through rate influenced by not just the single retailer but all of the retailers and have the pass-through rate not just a single distributor but all the distributors, and likewise for OEMs.

Q So because of what you've just said you do not calculate any specific pass-through rate per plaintiff based on the specific OEM, specific distributor, specific retailer that that plaintiff purchased through, correct? You just don't do that analysis.

A Your -- the premise of your question began with "because." There's another because which is the datasets are not available.

Q Okay. For whatever reason you don't do that analysis. For whatever reason, correct?

A That's correct.

Q Okay. And it is also correct, am I not, that you don't do any analysis concerning whether a specific plaintiff purchased a product and then got an after-store rebate or some other special discount, that's not something you look at specifically at all in calculating your overcharge

rate, correct?

A Well, I'm relying on the information that's provided me about the defendants that came from their depositions and the documents that are associated with that and I would hope that a defendant that actually got the kind of rebate you are talking about will reveal that in deposition, but absent that information I would assume there were no rebates.

Q Okay. Well, let me ask you that, okay?

When you did your damage analysis do you believe that you should have -- if a plaintiff gave information about rebates and discounts they received do you believe that you should have used that to net down the price in order to calculate the damages, is that your testimony now?

MR. GLACKIN: Object to the form.

THE WITNESS: No, I don't think that the existence of rebates has an impact on the damages at all, so I carried out the overcharge analysis strictly with regard to battery prices charged by the defendants, so the questions that you ask have nothing to do with that. And then after that it is strictly pass-through. And it is my opinion that bundling of rebates are -- don't alter the basic

answer is yes.
Q Okay. So you make no individual analysis in your damages regarding whether or not there were rebates, bundling or discounts?
MR. GLACKIN: Object to the form.
THE WITNESS: For the reasons --
Q BY MR. KESSLER: It doesn't matter to your analysis, correct?
A For the reasons I've already stated this was an exercise that was not needed.
Q Okay. Now --
MR. GLACKIN: Jeff, is this a good time for a break?
MR. KESSLER: Let me just ask one more question.
MR. GLACKIN: Sure.
Q BY MR. KESSLER: You haven't studied the specific distribution chain for any plaintiff to know, for example, whether their product used -- went through a packer or not or whether it went through an ODM or not or whether it went through a distributor or not, you didn't do that plaintiff by plaintiff, that analysis, correct?
A Again, because of limited information I didn't carry out that exercise.

Q Okay. And therefore you would calculate this -- your analysis calculates the exact same damages and pass-through to a particular plaintiff whether or not their product went through a packer, whether or not their product went through an ODM, whether or not their product went through a distributor before it got to the retailer where they made the purchase, correct?

A That's correct.

Q Okay. And finally, one last question, if someone bought the same product the same month at a retailer you would calculate the same damages as someone who bought the same product the same month directly from the OEM, correct? It doesn't matter to you in your pass-through calculation or in your damages?

A Well, we went through this before so if it is a hundred percent it doesn't matter. If it is a hundred percent each phase in the chain your hypothetical doesn't matter. If it -- which is my recommendation that we use the hundred percent. But if there were variability in the chain, if we had serious evidence of different pass-through rates at different points in the chain, then that potentially matters I think more for the delay than necessarily

Q Please teach me.
A I tell the students that the way to do data analysis are pictures, words and numbers. Pictures are visual displays of the data, words are explanations of what they mean, and last of all the numbers which are statistical analysis. You don't conduct statistical analysis separate from the words or from the data displays. So in this document I have a lot of data displays and a lot of words which I would consider in, within the umbrella data analysis, the kind of data analysis that I teach my students.
Q Very good. Thank you, sir. That's not my question.
My question is do you have any of the third things, the statistical analysis part. I promise you I will let you talk about this other data displays you've done. I want to first eliminate the possibility that you did any statistical analysis, any type of regression, to test the pass-through of price overcharges in the presence of focal point prices. I don't see that here, I just wanted you to confirm it is not here, that's all.
MR. GLACKIN: Objection; compound, asked and answered, vague.

THE WITNESS: I don't think there are any new regressions in these last two reports that speak to the focal point issue but I think I've added a lot of information about the role that focal points play in the context of the damage analysis.

Q BY MR. KESSLER: Okay. Do you add anything on focal points, and if you do show me where, okay, which indicates that there is a price pass-through in the -- an overcharge pass-through in the presence of focal points in the price as opposed to that there's a design adjustment or quality reduction? I want to distinguish your quality adjustment and your design adjustment arguments.

Is there anything new that you have added that price is passed through in the presence of focal points, any new data, any new -- you said display. You know, anything like that on the price pass-through part, please.

A Well, I have these MEI displays.

Q Okay. Let's talk about that. Do one at a time.

A The May 25th, 2018 report.

Q Okay. Let's stop at that point and do one at a time.

So you have MEI displays. MEI is a

Q The focal point prices changes you show, they always low -- the focal points, the next one, are generally going down, not up, to a lower price point, correct?
A That's correct.
Q In fact, that's the normal pattern for consumer electronic products, it comes in at an initial focal point price and then as time passes the prices quickly go down, correct?
A Because it gets out of date. Because the rate of technological improvement is so great they can't sell it at the same price anymore.
Q Right. Right.
So if you started at a focal point and then there is an overcharge experienced, okay, you don't really have an opportunity to raise the price to a higher focal point price because the product is now quickly becoming obsolete, correct?
A Your hypothetical is totally wrong. Once again, I'm not going to talk about the impact of a temporary increase in prices because all of my work concerns a permanent increase, and given that you have this permanently new path of battery prices that have an impact on a permanent path of cost, every one of these so-called focal point prices are

going to be designed, every one of those products are going to be designed in a way which is influenced by the elevated battery cost.

Q Okay. So is it now your testimony that all the injury from -- in focal point prices from an overcharge suffered a quality reduction and there's never any price pass-through? Is that your testimony now? Because it is a permanent in your view long-term price that what you are really testifying to is that when you buy at a focal point price the only injury you are always suffering is product quality reduction?

A Well, that's definitely the case at the introductory point but then you see in these MEI data you have very substantial price reductions, so --

Q But that doesn't indicate any further injury, right? As I understand your testimony, what you are saying is because it is a long-term permanent effect these are just built into the price points and therefore the only injury that will be suffered, you believe it has always suffered, is that you are getting a lower-quality product because it is built in, because it is long term, correct? Isn't that your testimony?

MR. GLACKIN: Object to form, compound.

THE WITNESS: My testimony is that the introductory point, the design is going to be appropriate to not only the costs that exist at that time but to some point predicting what the cost will be going forward and therefore the design will be influenced by the battery overcharge. Then the question is once you abandon the focal point like we see in Figure 13 and 14, the price reduction could be different depending upon the path of the battery overcharge.

Q BY MR. KESSLER: But you haven't measured that in any way, you haven't done any study that shows what's the different impact when focal points prices are reduced as to what -- if they have some differing overcharge effect then, right? You don't have any regression or study for that?

A Well, these figures, 13, 14 and 15, are meant to alert you to the fact that the focal point has meaning only for a couple of months and from then on the prices are set loose from the focal points.

Q Right. So a consumer who buys at the focal point and someone who buys the same product two months later would experience an entirely different

overcharge effect in your view, right?
A No.
Q They have the same effect? Same or different, you pick.
A I've got to think this through.
Q You are the expert. Think it through. Is it the same effect no matter when you purchase it or is it a different effect if you purchase at the initial focal points when you buy it like two months later with much lower prices?
A See, that original design for that focal point is going to have to take into account the changes in costs that come later and I think that the damage would be the same in the sense that the price path would be very similar under the -- regardless of the -- regardless of the battery price path. But this is a complicated question. I've got to think it more clearly through in order to give you an answer. Maybe after lunch I'll give you that answer.
Q Let me ask you this way.
Your damages study for the individual plaintiffs don't take any account as to whether or not the purchaser purchased at focal points, focal point prices, or at what point in the life of the

product they purchased the product, right?
A That's correct.
Q You just have the same damages estimate based on your monthly average overcharge calculation, correct?
A That's correct.
Q Right?
A But that's built on the conceptual framework that I guess we'll get to later on in which the overcharge is either felt through prices or through quality.
Q All right.
Not it is correct, isn't it -- you do two analyses now for the damages for the plaintiffs. You do one as if they experienced the overcharge in the month, as the same month that they purchased, and one is if they had a three-month lag, correct?
A That is correct.
Q Some products might stay in the stores for more than three months, correct? We know that.
A We see some of these that stayed more than three months.
Q Right.
A But not at the focal point.
Q Okay. But for products that stayed for more

A I would assume that some of them did.
Q In any event, as we sit here now you don't know if you built in any time for packers in your analysis or not?
A That is correct.
Q Now it is correct that you do think you built in time for distributors, right?
A That's correct.
Q Okay. But many times plaintiffs would have bought products that didn't go through any distributor at all, correct?
A That's correct.
Q All right. So -- and you didn't do any adjustment in your damage calculation for those plaintiffs to specifically figure out for an individual plaintiff what was the distribution path for that product so if it had one step, two steps, three steps, four steps, you just didn't do that analysis, correct?
A I didn't do this on a plaintiff-by-plaintiff basis.
Q In fact, isn't that correct that -- withdrawn.
Did you make any changes in your methodology to account for the fact that there's no longer a

class in this case and that this just an individual plaintiff damage claim, did that cause you to change any of your methodology for calculating let's say, for example, the amount of pass-through, the percentage of pass-through?

A The logic is these individuals, the named plaintiffs, are participants in a market. The market is a coordinated mechanism that creates all the movements common and move together over time so that was the reason that you don't need to do it on a defendant-by-defendant basis. The aggregate tells you something about the defendants.

Q So just to get a yes or no --

A I'm sorry, plaintiffs, plaintiffs.

Q So you did not do it on an individual plaintiff-by-plaintiff basis, you didn't calculate pass-through at all on an individual plaintiff-by-plaintiff basis; is that correct?

A That's correct.

Q Okay. And you also did not calculate overcharge on an individual plaintiff-by-plaintiff basis except that you applied your monthly calculation to the month in which they purchased or in the three-month lag.

A That's correct.

(Deposition resumed at 12:20 p.m.)

THE VIDEOGRAPHER: Back on video at 12:20 p.m.

BY MR. KESSLER:

Q Let me turn your attention now in your May 25th report to Page 23 and this is Paragraphs 53 through 58 or 57, I guess, in Figure 52.

In this set of paragraphs you rely upon a set of documents and also I believe testimony concerning Acer products; is that correct?

A Which paragraph?

Q Paragraphs 53 through 57 including Figure 2.

A That's correct.

Q And you are using these materials as support for your conclusion that quality adjustments downward would be made in the products at issue in this case in response to overcharges when the products are sold at focal point prices; is that correct?

A Well, this is mostly about small cost changes are part of the consideration at the design phase.

Q All right. Now the products that are discussed here, these Acer materials, are desktop computers, correct?

A That's correct.
Q Okay. Are desktop computers at issue in this case?
A No.
Q Okay. You are not claiming anything or calculating damages for desktop computers, correct?
A That's correct.
Q Desktop computers don't use lithium ion batteries, correct?
A That's correct.
Q Now I will just ask you why did you include this.
A Because it illustrates how a significant manufacturer of computer electronics deals with the design and deals with small costs at the design phase and I think I agree that this is not a laptop but I'm quite certain the same kinds of calculations go into designing a laptop as would go into a desktop. Namely they're going to be a tradeoff of very small costs and components.
Q Have you done any analysis at all generally of desktop pricing in the marketplace, how it compares to laptops?
A Which pricing?
Q Pricing of desktops versus laptops. Have

you studied any data on that?
A In my whole life or in this?
Q In this case.
A In this case, no.
Q Do you know if desktops are sold through different channels to some degree than laptops?
A They could be, yes.
Q Yes.
Now before this you cite going back to the paragraph before 52, you cite some testimony, I believe, from representatives of HP and Dell, correct?
A Correct.
Q Okay. Are you aware of evidence in this case where HP has filed SEC disclosures saying that they do not pass through cost increases from their suppliers in their finished products because the market is too competitive and they're not able to do that?
A No, I'm not aware of that.
Q Do you know that such documents exist in this case?
A I'd have to see what it says because what you said was a remarkable statement and I haven't seen it.

plaintiff?
A That doesn't seem like a judgment that I should be making.
Q Okay. Someone else will make that judgment.
Let me ask you this next. In your Sony camcorder battery study, this is on Paragraph 19 so it is right after this in your reply, Page 11.
A Yes, sir.
Q Okay. So you conclude that Dr. Haider was correct that the second battery in this study was a coin cell battery, correct?
A That is correct.
Q And a coin cell battery is not a product in which there was alleged to be any overcharge, correct?
A That's correct.
Q Okay. It is one of the components of the -- of the product that is not part of the alleged conspiracy just like other parts of the product, whether or not it is a metal casing or, you know, something else besides the cell. It is not part of the alleged conspiracy, correct?
A That's correct.
Q Okay. So when you redo your study you now include in your pass-through analysis not just the

You previously have testified and you stated in your current reports that you have no way to determine what the actual quality reduction is for any particular plaintiff, correct?

A By actual quality reduction you mean the specific components?

Q Yes. What feature was changed, what it would have looked like. You have no way to measure that or determine that, correct?

A No, I do not know what --

MR. GLACKIN: Wait. Just let him finish.

MR. KESSLER: Sure.

MR. GLACKIN: For her benefit.

MR. KESSLER: Go ahead.

THE WITNESS: I don't know which features changed but I know that the features cost more and that the design had to adjust for those higher costs.

Q BY MR. KESSLER: Right, right. But you haven't done, even on that point you haven't done any specific regression or statistical analysis to show what specific component cost changed with respect to any particular product? In other words, you don't have a regression that says for this product these are the components that changed, for

this product these are the components that changed.
You don't do any analysis like that, right?

A I don't even I think of it that way. I think what happens is that at any given price, whether it is focal point or not, you are going to get a new array of products that take advantage of the -- if it is lower cost, take advantage of lower cost, and some people will prefer longer battery life, some people will prefer a better screen. There will be a whole array of different products at that given price.

Q In fact, I think what you wrote in your report is that in the but-for world where there would be a different group of products produced at a higher quality according to you, you don't even know how to predict which product an individual plaintiff would have picked because one plaintiff might not need more memory and another plaintiff might not need this particular feature so that there's no way to know what would be the combination of features that a plaintiff would actually purchase in the but-for world; is that correct?

A Well, I just want you to be aware that I discussed this in regard to price competition as well, the same problem, because in the world with

lower battery prices there are people who didn't buy a battery before who would in a but-for world and since are being damaged. But we can't tell you who they are going to be and likewise we can't tell in a case of quality competition the exact kind of notebook or camcorder that these individuals are going to buy. What we know is whatever they're going to get is going to benefit from the lower prices in the but-for world, the lower battery prices. It would be higher quality. Exactly what the quality components are is impossible to predict.

Q Right. So because it is impossible to predict, not even just what would be the different components but what would be the product purchasing decisions in the but-for world, there's no way to do an analysis where you say here is the product that they would have bought and here is the product that they did buy and do a comparison of those two products, it is just not possible to do that, right?

A But I explained in that section, I go through it explicitly, so beginning on Page 16, Paragraph 35, I talk about this what economists for maybe a hundred years have talked about --

Q Which page, I'm sorry?

A Page 16, May 25th document.

think that the damages would be -- it is the same in the sense that the price path would be very similar under the -- regardless -- regardless of the battery price path but this is a complicated question. I've got to think it more clearly through in order to give you an answer. And then you said maybe after lunch. That's the one I didn't ask you about.

A Did I tell you what day at lunch?

Q So my question is do you have any answer now as to whether or not, you know, that if a consumer who buys at a focal point, that someone buys the same product a few months later when it is at a lower price than the focal point whether or not they would have the same -- the same injury or a different injury or how would they compare to each other?

A Well, it would be a product that had a lower quality.

Q But it is the same product?

A Same product over time but it was lower quality than in the actual world.

Q All right.

A So then the question is what's the price path in the actual world, it is a lower quality product, and I think it would be the same, I'm not

sure about this, but I think it would be the same. So your question about whether this is quality or mostly quality, I think the answer is yes.

Q Mostly quality.

A That's what I think right now.

Q Okay. So as you are sitting here right now your opinion is that the person who buys the product later would suffer the same quality injury as the person who bought at the focal point price but not necessarily any additional price injury beyond the quality reduction?

A I'm sitting here again trying to think about what would determine the rate of price decline after the focal point is abandoned and it strikes me it is probably pretty much the same in the actual and but-for world.

Q So in the case of those who purchase at the focal, for those products sold at focal point prices now your opinion is it is basically a quality injury that you're calculating, no other type of injury, correct?

A You know, based on you asking me this question and me thinking it through that's my current position, yes.

Q And in any event, your damages model doesn't

EXHIBIT 2

IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION

CONFIDENTIAL – TO BE FILED UNDER SEAL
SUBJECT TO PROTECTIVE ORDER

IN RE: LITHIUM ION BATTERIES ANTITRUST LITIGATION **THIS DOCUMENT RELATES TO:** **ALL INDIRECT PURCHASER ACTIONS**	**No. 13-MD-02420 YGR (DMR)**

EXPERT REPORT OF EDWARD E. LEAMER, PH.D.

May 25, 2018

TABLE OF CONTENTS

I. Assignment and Summary of Conclusions

1. I have been asked by counsel for the Plaintiffs in this case to estimate damages to the Plaintiffs from the Defendants' conspiracy that inflated prices of cylindrical lithium ion batteries ("LIB"). This involves a) estimating the impact of the conspiracy on prices of the lithium ion battery cells and b) estimating the portion of the inflated price passed on to the final purchasers (pass-through).

2. I previously submitted four reports that addressed both of these issues.[1] I stand by all the analysis in those reports, and I incorporate within this Report the analysis and opinions in my previous reports. With respect to item (a), in my Opening Report I presented a regression model that estimated the amount of overcharges paid by the direct purchasers of lithium ion batteries.[2] In my subsequent report, I addressed the concerns presented by the opposing expert and confirmed that this model is an adequate approach to estimate overcharges.[3] My conclusions in this regard have not changed. I use this model as the basis of estimating damages to the Plaintiffs.

3. With respect to item (b), in my previous reports I presented an extensive discussion and analysis of pass-through in many different circumstances and concluded that at least 100 percent of the overcharges were passed on to the final purchasers.[4] I calculated Plaintiffs' damages using a 100 percent pass-through rate and the empirically-estimated pass-through rate in my previous report.

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[1] Corrected Expert Report of Edward E. Leamer, Ph.D., February 2, 2016 ("Leamer Opening Report"); Expert Reply Report of Edward E. Leamer, Ph.D., August 23, 2016 ("Leamer Reply Report"); Supplemental Expert Report of Edward E. Leamer, Ph.D., September 26, 2017 ("Leamer Supplemental Report"); Supplemental Expert Reply Report of Edward E. Leamer, Ph.D., November 21, 2017 ("Leamer Supplemental Reply Report").

[2] Leamer Opening Report, 51-58.

[3] Leamer Reply Report, 7-45.

[4] Leamer Opening Report, 68-76; Leamer Reply Report, 45-83; Leamer Supplemental Report, 7-66; Leamer Supplemental Reply Report, 14-69.

4. I was asked to address the concerns with pass-through raised in the Court's second order denying class certification.[5] These concerns related to the question of whether and to what degree "focal points" affect the impact of the overcharges on consumers. Specifically, I address in this report the following concerns raised in the Order:

a. "Defendants argue that Dr. Leamer's analysis does not establish whether such quality-based "pass-through" ever occurred, or in what amounts, and that his analysis is pure theory without any factual support. The Court agrees. While Dr. Leamer offers various kinds of statistical data analyses to support his economic theory of quality adjusted pricing, these analyses do not demonstrate that any products (and thus the purchasers of those products) actually experienced a quality reduction, rather than an increased cost, as a result of the alleged price-fixing conspiracy. As he concedes, Dr. Leamer's hedonic equations are offered only to show the opportunities for design changes in response to focal point prices, not actual changes. His analysis of when cost increases result in focal point price increases seems to demonstrate little more than that product cost changes correspond to product price changes, an unsurprising result."[6]

b. "Moreover, assuming that consumer class members experienced quality reductions rather than price differences, Leamer does not explain how the existence of those quality reductions affects the reliability of his prior overcharge pass-through regression calculations. Those calculations were based on actual cost and price data for different points along the distribution chain for the products at issue. If the relationship between the cost and price data was skewed by the effects of artificially holding the price constant, while changing the quality of the product obtained for that price, how then should Dr. Leamer's previous cost/price regressions be interpreted? Dr. Leamer does not explain how the quality adjustments—which logically would occur at the OEM level of the distribution chain—would affect pass-through

[5] Order Denying IPPs' Renewed Motion for Class Certification; Granting Motion to Strike Expert Report of Edward E. Leamer, Ph.D., March 5, 2018 ("Order Denying Class Cert").

[6] Order Denying Class Cert, 6-7.

rates for points later in the distribution chain, particularly the retailer level where the pricing decisions would be most volatile and, seemingly, most likely to be affected by the focal point pricing strategy."[7]

c. "…[R]egardless of whether focal point pricing is limited or prevalent for products purchased by the putative class members, its effects on IPPs' ability to demonstrate pass-through, and to quantify it for purposes of damages, are not explained adequately by Dr. Leamer."[8]

5. I summarize these responses to these three questions below and my more detailed responses are later in this document.

6. **With or without focal point prices there is both price and quality competition in consumer electronics.** I explain below that competition in the highly competitive market for consumer electronics occurs via both improvements in quality and also reductions in price. The many data analyses I have performed on pass-through demonstrate that competition at every level of these markets is intense. This means that a battery overcharge would cause a higher price of specific finished products or a lower finished product quality for the same price or most likely some combination. The focal point hypothesis puts the emphasis on quality competition, but even with focal point prices there is price competition via non-focal point introductory pricing, markdowns, rebates, and bundles and even without focal price points, there is plenty of quality competition and vast improvements in consumer electronics that sell for about the same price at different points in time.

7. **The evidence of quality competition in consumer electronics is overwhelming.** Per the Courts' decision: "Defendants argue that Dr. Leamer's analysis does not establish whether such quality-based "pass-through" ever occurred, or in what amounts, and that his analysis is pure theory without any factual support. The Court agrees." I strongly disagree. The evidence of quality-based pass-through is overwhelming. Again in this document I discuss

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[7] Order Denying Class Cert, 7.

[8] Order Denying Class Cert, 7-8.

the quality-adjusted price indexes for laptops created by the Bureau of Labor Statistics. Per Bureau of Labor Statistics (BLS) estimates, the type of laptop computer that sold for $1,000 in 2000 would have been sold for only $40 in 2010, if it had been available. This is not a gift from the sellers. This occurs because the large cost reductions for laptop functions have been passed on to consumers both with lower prices and higher quality. On the matter of the amount of the pass-through, I have performed 110 pass-through studies and have found very strong support for 100% pass-through or more.

8. **I agree that it is not surprising that product prices and costs are closely aligned.** The Court has found that "His analysis of when cost increases result in focal point price increases seems to demonstrate little more than that product cost changes correspond to product price changes, an unsurprising result." This is not a "little more" finding. The alignment of costs and prices in the actual data is the critical piece of evidence regarding pass-through. Given the competitive nature of the consumer electronics business, what would be surprising is if there were no close relationship between costs and prices. What is not surprising is the lack of evidence for the Defendants' unstated hypothesis that pass-through is suspended for LIB.

9. The division of the LIB overcharge between the lower quality effect and the higher price effect is not possible without extensive data on consumer behavior. The Court says that I have failed "to demonstrate that any products (and thus the purchasers of those products) actually experienced a quality reduction, rather than an increased cost, as a result of the alleged price-fixing conspiracy." The counterfactual being proposed by the Court seems to be that a sudden price increase by the cartel diminished the quality of a particular laptop, power tool or camcorder that existed ex ante. But this conceptualization ignores both the continuous nature of the conspiracy effect, and the omnipresent forces of innovation and product improvement in consumer electronics industries.

10. It may be more helpful to think of the but-for world as offering a different array of prices and products than the actual world does, with lower prices for the same products and higher quality products at the same prices. Note that this would be the case regardless of the presence of focal point prices. Then

the Court would appear to be suggesting that it is somehow feasible to determine the particular differences in consumer transactions when confronted with two different arrays of prices and products. The Court has correctly found that I did not take on this task. There are two reasons for this. First of all, I am not aware of any datasets that might help to predict what OEMs and consumers would have done in the but-for world when confronted with a new array of possible prices and products. Second, and more importantly, for my task of estimating damages, these kinds of predictions are neither helpful nor necessary. For reasons fully explained below, the lower bound estimate of the damage in all cases is the battery overcharge. Third, the but-for comparison is a construct, accepted as the conventional way of estimating damages in antitrust matters. And with any construct, you don't have actual behavior to observe, but instead must rely on inferences drawn from the actual world, including statistical studies, economic theory, and documentary and testimonial evidence. I have analyzed all of this evidence and it consistently supports that regardless of whether a consumer would have bought the same computer or a better computer, he or she would have been harmed in the amount of the conspiratorial overcharge.

11. **Focal point pricing does not suspend the basic economics of a competitive marketplace or "skew" the basic relationship between price and cost: prices and costs must be closely aligned.** The Court has posed the question: "If the relationship between the cost and price data was skewed by the effects of artificially holding the price constant, while changing the quality of the product obtained for that price, how then should Dr. Leamer's previous cost/price regressions be interpreted?" The premise of "skew" is not valid. Competition to attract customers puts relentless pressure on firms to cut prices or to spend more to improve product quality. Pushing in the other direction is the fundamental existential force: firms must overall charge enough to cover their total costs or go out of business. In highly competitive settings, these two offsetting forces keep prices and costs closely aligned, whether there is price competition or quality competition or both, a fact that I have confirmed in multiple studies of pass-through. In the case of focal point prices, the pressure on firms is to create a product with a quality that is attractive compared with other products offered at the same price. That assures that the

total costs are aligned with the focal price points. Of course, the relationship between cost and price is not instantaneous and the delay between cost changes and price changes may be affected by focal price points. To deal with this issue, I have used "dynamic" models of the relationship between prices and costs which allow cost changes to have delayed effects on prices.

12. **The existence of focal point prices has no impact on the reliability of my pass-through estimates.** The Court expresses the concern, "Moreover, assuming that consumer class members experienced quality reductions rather than price differences, Leamer does not explain how the existence of those quality reductions affects the reliability of his prior overcharge pass-through regression calculations." There is no reason for concern about this. The pass-through work in all my reports, including the first, has uncovered a stable and positive association between sales price and total cost of various products across time and across products. This relationship between sales price and total cost means the margin of price over total cost is relatively constant. A constant margin is evidence of pass-through for either price competition or quality competition. With quality fixed but price variable, a constant margin means that any cost reduction is matched with a price reduction. With price fixed but quality variable, a constant margin means that any cost reductions for some or all of the components are offset with enough quality improvement in some of the components to keep total cost roughly constant.

13. **Pass-through of cost reductions via quality improvements begins with product design by OEMs.** The Court has said that "Dr. Leamer does not explain how the quality adjustments which logically would occur at the OEM level of the distribution chain—would affect pass-through rates for points later in the distribution chain, particularly the retailer level where the pricing decisions would be most volatile and, seemingly, most likely to be affected by the focal point pricing strategy." My explanation is that focal point pricing is a retail sales strategy which clusters the retail prices of various similar products at or close to the same retail price to facilitate consumer shopping. While retail stores can establish and maintain focal point pricing they cannot by themselves pass reductions of costs of components onto the customers with improvements in quality. That takes OEM involvement. The existence of retail

focal point prices is understood by OEMs, and an OEM which would like to benefit from focal point pricing at the retail level has to design a product and choose a factory gate price that guarantees that the product reaches the retailer at a retailer acquisition cost that is close to but below the retail focal price point, leaving an appropriate retail margin. Examples of such conversations among product designers at [redacted] are discussed below. These conversations include representatives from retail outlets.

14. The OEM level of the distribution chain, highlighted by the Court as an area of concern, has been the subject of intensive work. I analyzed the relationship of price to total cost for fourteen firms accounting for over $60 billion in commerce. Individually and in aggregate, those regressions showed that changing total cost led to changes in the total price by more than a one-to-one ratio, confirming what we all know as a matter of common sense and experience: the manufacture and sale of consumer electronics at the OEM level is highly competitive. Consumer electronics OEMs do not have market power and cannot dictate terms to their customers. These results alone fully support the conclusion that consumers ultimately suffered the full brunt of the conspiracy, either through an increased price or a diminishment in quality relative to the but-for world. The answer to the Court's question about the reliability of this prior work is that it is perfectly harmonious with my subsequent work on quality substitution. All the analyses point in the same direction: intense competition.

15. However, in the interest of completeness, I have performed numerous data analyses to explore the hypotheses of the Defendants' experts about things such as small cost changes, changes over time, and focal point prices. I have analyzed small cost changes: my analysis confirmed that even cost changes of $3.5 or less tend to be passed on to customers on a 1:1 basis. I have analyzed the impact of battery cost changes on the price of Toshiba laptops: that analysis shows a complete pass-through of battery costs.[9] Lastly, I have analyzed pass-through over time for potential focal points and non-focal point

[9] Leamer Opening Report, 74-75; Leamer Reply Report, 74; Leamer Supplemental Reply Report, 67-68.

and found that pass-through rates for both types of prices are concentrated around 100%.

16. I have also approached the issue of focal point pricing in a variety of ways. My multiple analyses of focal point prices again confirm that focal point prices charged by retailers do not allow OEMs or retailers to exercise market power and earn additional, supra-competitive margins. Retailers are sophisticated customers in a competitive marketplace and will not allow an OEM to hold prices or quality steady in response to a reduction in battery cost. To the contrary, they face intense competitive forces in their own sales markets. A retailer who behaved as Defendants' experts propose would soon be out of business.

17. Instead, my data analyses and the evidence on the record show just what economics predicts: that the effect of focal point prices is to compel OEMs to hit focal point costs such that if batteries had been cheaper, the retailer would have received a laptop, camcorder, or power tool of the same overall cost but of higher quality. In particular, 1) I demonstrated that actual focal points do not last very long because either prices are cut or the products are entirely removed from the shelves;[10] 2) I showed that quality of features have substantially improved over time while prices and costs stayed about the same as evidence that quality improvements substitute for reductions in price points;[11] 3) I demonstrated the variety of component options available at manufacturers' disposals to make quality adjustments;[12] 4) I presented analysis that the pass-through rates at potential focal point prices and non-focal point prices are clustered both around 100%.

18. In this report, I present additional evidence from new documents, new testimony, as well as data that support my opinions and demonstrate how OEMs adjust the quality of various components, large and small, including batteries, to meet a target or "focal point" retail price. In particular, I present

[10] Leamer Supplemental Report, 42-46.

[11] Leamer Supplemental Report, 47-54; Leamer Supplemental Reply, 20-22.

[12] Leamer Supplemental Report, 55-58; Leamer Supplemental Reply 23.

new testimony from OEM representatives and new documentary evidence 1) confirming the intense competitive nature of this industry which force the manufacturers to innovate frequently and maximize the quality of products; 2) confirming that products are designed around any potential retail price points keeping cost targets in mind; and 3) demonstrating how specific components, with even quite small costs, are being substituted for one another to maintain price and cost targets. In addition, I present data analysis providing additional evidence that 1) quality changes are made to maintain similar price points; 2) the shelf life of products and focal points are short; 3) battery quality used in products was negatively related to battery costs such that lower but-for prices would likely result in higher quality; 4) pass-through rate is not materially different with and without conspiratorial overcharge in battery; and 5) as in notebooks, camcorder data is consistent with complete pass-through of battery costs.

II. Quality Competition and Damages in the Presence of Focal Point Pricing

19. When a firm's product costs change, its choices are: do nothing or change the price and/or modify the product. A competitive market makes "do nothing" not an option. As I noted previously:

> Standard microeconomic theory shows that the only situations in which exactly zero pass-through would be expected in the face of a cost increase are if either a) an entire industry (not individual producers within the market) faced a perfectly elastic (i.e., horizontal) demand curve; or b) the market supply curve is perfectly inelastic (i.e., vertical) at the margin. The demand curve for LIB batteries which have no viable substitutes in many applications is surely not perfectly elastic. A perfectly inelastic supply curve is also highly unlikely because even with manufacturing capacity constraints output can be increased with multiple shifts and more rapid operations. Therefore, with the zero pass-through scenario a highly unlikely outcome for theoretical reasons, we should be regarding as highly probable that at least a portion of increased LIB costs were passed through to computer and

consumer electronic equipment prices. There is consequently some harm to consumers of these products that would be a consequence of a successful collusion that raised LIB prices.[13]

A. Businesses Compete via Lower Prices and Improved Quality

20. A standard theoretical result that underlies a study of pass-through when price is variable and quality is fixed is the cost markup rule which is derived from the assumption that firms maximize profit.[14] This markup rule sets product price, p, equal to marginal cost, c_{MC}, times a multiplier that depends on the price elasticity of demand, η_p, which indicates the percentage change in quantity of sales with respect to the percentage change in product price:

$$p = c_{MC}\left(\frac{1}{1+1/\eta_p}\right) \qquad (1)$$

21. This markup is greater if the firm has market power (faces inelastic demand) indicated by a negative demand elasticity η_p close to -1. This price rule approaches the perfectly competitive outcome with 100% pass-through, $p=c_{tot}$, as the elasticity approaches minus infinity. But otherwise, with adequately elastic demand, $-\infty < \eta_p < -1$, a change in marginal costs is more than 100% passed on to buyers. That's the markup.

22. If we assume that price is fixed but quality (x) is variable there is an analogous result. Assume that marginal cost can be written as the product of a fixed constant c_x times a measure of quality x:

$$c_{MC} = c_x x$$

23. For example, one can think of x as the battery capacity and c_x as the cost of capacity, which varies over time (generally getting cheaper).

[13] Leamer Opening Report, 65-66.

[14] Hal R. Varian, *Intermediate Microeconomics: A Modern Approach*, 8th ed., (W. W. Norton & Company, 2010), 400-441.

24. The profit to be maximized by choice of quality x is sales volume D(x) times the difference between price and cost: $D(x) * (p - c_x x)$. Profit maximization then implies a markup rule that is similar to (1) but depends on the elasticity of sales with respect to quality improvements, η_x:

$$p = c_x x \left(\frac{\eta_x + 1}{\eta_x}\right) \qquad (2)$$

25. This markup is equal to 100% in the infinitely elastic case but otherwise is greater than 100%. The infinitely elastic case applies when the smallest reduction in quality makes the firm lose all its customers and the smallest increase in quality yield a huge increase in sales. That is the perfectly competitive case.

26. Equations (1) and (2) with appropriately chosen elasticities are mathematically identical, but (1) describes how prices p change when marginal costs change, while (2) describes how quality x changes when the cost of quality c_x changes. Both equations describe a relationship between price and cost, and a study that confirms that price and cost are correlated can be taken as support for either (1) or (2). Either, per Equation (1), higher marginal costs c_{MC} are passed on to consumers via higher prices, or per Equation (2) higher costs of components c_x are passed on to customers via quality reduction x, just enough to keep the total marginal costs $c_x x$ constant.

27. I do not intend to suggest with these two equations that there are two distinct forms of competition. Competition occurs in both price and quality. Then profit maximization requires both (1) and (2) to hold at the same time. To solve these jointly we need the elasticities to adjust as price and quality change. For example, an improvement in quality may lower the price elasticity and an increase in price may increase the quality elasticity.

B. Consumer Electronics Products Have Experienced Huge Quality Improvements

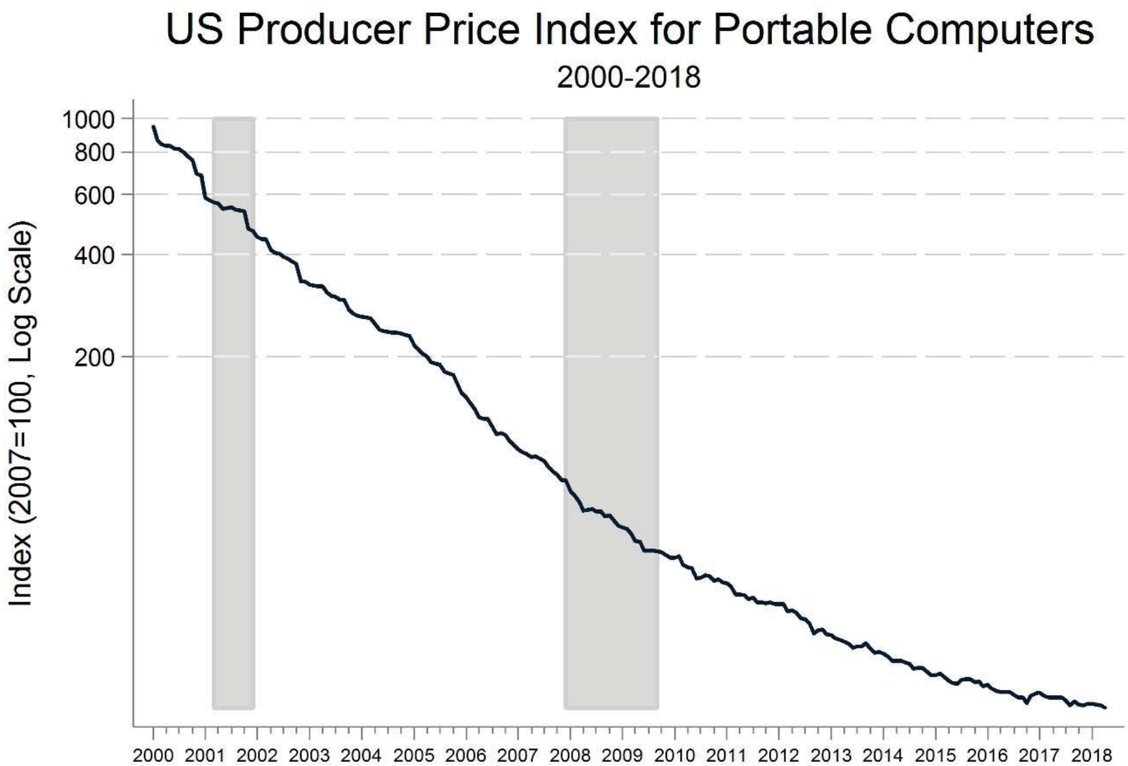
28. The demand curves facing sellers of products that use batteries depend on both price and quality, and competition can occur either by lowering price or by improving quality as the prices of batteries and other components fall. For many products, quality is only slightly variable and the competition is mostly

via prices. However, in consumer electronics there have been vast improvements in quality and huge pressure on sellers of products to keep up with improving quality over the last several decades. (Think Moore's Law: The overall processing power of computers doubles every two years.)

29. Figure 1 below illustrates the quality-adjusted wholesale prices for portable computers, laptops, PDAs and other single user computers as computed by the BLS. According to this display, a laptop that sold for the wholesale price of $1,000 in 2000 would have sold for about $40 in 2011.[15] However in 2011, laptops were being sold, not at $40, but for about the same prices as in 2000 but with great improvements in features compared with the $1,000 laptop in 2000.

[15] The BLS computes a quality-adjusted price by estimating what a laptop with the out-of-date year-2000 features would have sold for in 2011, had it been on the market. That is the $40 estimate of the BLS statisticians.

Figure 1



Source: Bureau of Labor Statistics

C. This is an Industry in Which Part of the Effect of a Slower Descent in Costs Would be a Slower Increase in Product Quality

30. The quality improvements that are evident in the huge decline in quality-adjusted prices for portable computers, illustrated above, are made possible by reductions in the costs that were incurred to build laptops with the features that consumers desire: speed, memory, display quality, battery life, and so on. [redacted]

[redacted]

[redacted][16]

31. Any interference in the freely functioning marketplace which slows the rate of decline of the costs of components would slow the rate of quality improvement, and thus would slow the rate of decline of quality-adjusted prices.

32. An important point here is that the focal price point hypothesis does not raise a new concern about quality competition. If the effect of retail focal point prices were to completely fix the prices of finished products on the retail shelves at the focal points, then all of the effect of a successful but illegal slowing of the rate of descent in costs would operate through quality and not through price. But even without the full force of the focal point hypothesis, some part of the impact of the conspiracy would be felt through lower quality, and some through higher price. In other words, it is impossible to escape the fact that a conspiracy that raises the costs of components of finished goods in the consumer electronics industries is felt through lower quality of the final products as well as higher price. For that reason, to capture the full magnitude of the impact, the damage analysis for this industry needs to monetize the loss in quality.

D. Damages Calculations

1. A Damages Analysis with Price Competition Could Consider What Customers Would Have Done in the But-for World

33. Damage from a cartel that raised product prices depends on what would have occurred in the but-for world in which the cartel was not operating. In a world with price variability but no quality variability, any customers who bought items in the actual world would have bought the same items in the but-for world for

[16] [redacted]

a lower price because the lowering of the price would only make the item more attractive. Then the price difference between the actual world and the but-for world measures the monetary damage suffered by buyers. For computing the monetary damages it doesn't matter what these buyers would have done with the extra money they would have had in the but-for world. The monetized damages for the purchases that occurred in the actual world are the same.

34. There are, however, additional effects on individuals who chose not to buy the product in the actual world because the product was too expensive, but would have bought the product in the but-for world with the lower product prices. Assessing the monetized value of the benefit that would come from increased sales in the but-for world is what economists call the Harberger triangle, which depends on the preferences of consumers.[17] I bring this up only because assessing the value of the quality improvements in the but-for world has a Harberger triangle aspect discussed next. I avoid any issues associated with these Harberger triangles by reverting to the lower bound estimate of damages which is based only on what individuals actually bought, not on what they might have bought.

2. Incorporating Quality Competition and Customers' Choices into the But-For World Would Result in a Higher Damages Estimate

35. Quality improvements that would have occurred absent an illegal conspiracy may not seem as easy to monetize as the overcharges that occur with price competition but the battery overcharge again is the logical underestimate of the damages. The economics literature has a standard way of monetizing the benefit from lower prices of some items: Hicksian compensation. Hicksian compensation answers the question: How much more money is needed at the initial higher prices to attain the same level of utility that would have been realized if the battery price had been less?[18] This is the monetized benefit of the fall in battery price. It's the extra money needed in the world of actual prices

[17] Arnold C. Harberger, "The Measurement of Waste," *The American Economic Review* 54, no. 3(May, 1964).

[18] Andreu Mas-Colell, Michael D. Whinston and Jerry R. Green, *Microeconomic Theory* (Oxford University Press, 1995), 62.

that is required to attain the same level of utility that would have occurred with the but-for lower battery prices. This amount depends on what customers would have purchased in the but-for world with lower battery prices. A consideration of consumer behavior in the but-for world seems unavoidable with quality competition, but for reasons explained below, the minimum level of the Hicksian compensation is the battery overcharge, which is what I am recommending as a damage estimate, because to claim more would require information about consumer behavior that I do not possess.

36. The algebra of this damage estimate is quite straightforward. Consider a product with two components, x and y, where x is the battery and y some other component. Denote the product design in the Actual world by x_A and y_A and the product design in the But-for world by x_B and y_B. Assume that product design in the actual and but-for world have the same Total costs but not necessarily the same product design:

$$Total\ Cost = c_{xA}x_A + c_y y_A = c_{xB}x_B + c_y y_B$$

37. where $c_{xA} > c_{xB}$ are the costs of x in the Actual and But-for world, and c_y is the cost of y which is the same in the Actual and But-for world. The lower cost of x in the But-for world allows for either or both of x and y to be greater. The Hicksian compensation is the cost of the But-for design measured in Actual prices minus the Actual Cost:

$$Damage = \left(c_{xA}x_B + c_y y_B\right) - \left(c_{xB}x_B + c_y y_B\right)$$
$$= \left(c_{xA} - c_{xB}\right) x_B$$

38. This damage is the difference between the cost of batteries in the actual versus the But-for world, times x_B the volume of batteries in the But-For design. This brings us to the same situation we had with regard to price competition: there are damages that come from sales of batteries that did not occur in the actual world but would have occurred in the but-for world. Because of the difficulties of estimating reliably this feature of the but-for world it is better in both cases to adopt the conservative estimate with the batteries x_B in the but-for world assumed the same as x_A. Then the damage is exactly what we have always

maintained: the battery overcharge times the volume of batteries actually purchased.

$$Damage\ Lower\ Bound = (c_{xA} - c_{xB})\ x_A$$

39. My advice in the case of price competition is to ignore the damages that flow from purchases in the but-for world that did not occur in the actual world, because any statistical analysis would have a hard time identifying these additional purchases and an even more difficult time linking additional purchases to individuals who should be included in the class. It is thus wiser to accept the smaller damage estimate that comes from actual purchases in the actual world.

40. My advice in the case of quality competition is similar: while there are very good reasons to expect the monetized value of the benefits that come from lower battery prices to exceed the battery overcharges, it is unlikely that we could form a reliable method of inferring consumer preferences and predicting consumer behavior in the but-for world, properly allowing for the fact that different people would have made different choices. That would leave us in a speculative position – the damage exceeds the battery overcharge but not by an amount that can reliably be determined. Better, again, to use the battery overcharge as a conservative measure of the damages.

III. Documents, Testimony, and Data Demonstrate Quality Adjustments

A. Documents, Testimony, and Data Show that OEMs Make Quality Adjustments to Sell Products at Desired Price Points

41. The court expressed a concern that, in the presence of focal points, there is no evidence that any product or purchaser experienced a quality reduction. Below, I discuss new documentary evidence and new testimony that address this issue. This new evidence demonstrates that manufacturers indeed make quality adjustments in response to component cost changes and this is true in the presence of focal point prices.

42. An obvious place to look for quality adjustments in response to changes in LIB costs is in the choice of LIB within the finished product. However, that is not the only place the responses can be made. In fact, a quality response may include no change in the battery whatsoever. The response to lower battery prices will depend on two things: 1) the types of quality adjustments available to the OEM, and 2) the attractiveness of the various types of feasible quality changes to consumers.

43. With respect to the first issue, OEMs' quality adjustments are limited to the set of available components, including LIB. As I discuss further below and showed in my earlier Reports, the many components together offer a broad range of options for cost changes that keep the sum of the costs equal to the targeted total cost, some options involving large cost changes and others involving small cost changes.

44. The second issue is the consumer response. The OEM problem is to design a product with a selected total cost which is maximally appealing to consumers and would have the greatest sales volume. If sales are less sensitive to other feasible component quality changes than to LIB quality changes, the OEMs will elect to change other components and leave the LIB unchanged.

45. That quality changes occur in a variety of components, both LIB and other components, is supported by a review of the documents and data. These changes allow OEMs to design a competitive product targeting the total cost that allows retailers to sell at specific retail prices.

46. There is ample evidence that manufacturers target specific total costs and trade off improvements in some components with reductions in quality of others in order to create a product that can be sold at a specific retail (focal point) price. In doing so, they take into account all components, large and small, and often make cost adjustments of rather small magnitudes.

[redacted]

[redacted][20]

47. Intense competition pushes OEMs to make products with the highest quality features and the maximum possible value for consumers given the expected retail price. [redacted]

[redacted][21]

[redacted].[22]

48. [redacted]

[redacted].[23]

49. OEM representatives testified they paid very close attention to what the competition has to offer and what technological improvements are expected.

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19 [redacted]

20 [redacted]

21 [redacted]

22 [redacted]

23 [redacted]

They would monitor the market on a "daily" basis[24] or a "weekly basis,"[25] which involved going through internet advertisements, newspaper offerings, and industry reports.[26] The intense competition is in large part driven by the transparency of the components used in the products and commonality of sources and options available to OEMs.

[redacted]

[redacted][30]

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24 [redacted]

25 [redacted]

26 [redacted]

27 [redacted]

28 [redacted]

29 [redacted]

30 [redacted]

50. It is evident that, to the extent focal points are relevant, products are designed (or configured) around these focal points. The retailer begins with a price point, sometimes in negotiations with the OEM, and that's what the SKU is designed around.[31] For example, [redacted][32]

51. [redacted]

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[31] [redacted]

[32] [redacted]

[33] [redacted]

[34] [redacted]

[redacted].[36]

52. The court is concerned that, in the presence of focal points, small cost differences would result in no action from the OEM. However, there is ample evidence that manufacturers account for all costs in the design and there is a quality response even with small cost changes.

[redacted][37]

[redacted][38]

[redacted][39]

53. The documents below also demonstrate how quality adjustments are made with small component costs. The record contains examples of internal manufacturer

35 [redacted]

36 [redacted]

37 [redacted]

38 [redacted]

39 [redacted]

communications in this regard. [redacted]

[redacted]

[redacted]

[redacted]

[redacted]

[redacted][40]

[40] [redacted]

54. [redacted].[41]

[redacted]

55. [redacted]

41 [redacted]

42 [redacted]

[redacted]

56. [redacted][45]

57. [redacted].[46] This example is a direct real-world demonstration of exactly the type of quality adjustment in the face of focal point pricing that I described in my earlier reports. It shows that switching out components with varying features and quality attributes in order to meet a price point is not something that only

[43] [redacted]

[44] "Definition of: heat sink," PCMAG, https://www.pcmag.com/encyclopedia/term/44193/heat-sink.

[45] [redacted].

[46] [redacted]

happens in a hypothetical textbook model, but is very much part of the product design process.

[redacted]

58. OEM data shows that there were options available and used for smaller cost components in notebooks. Figure 3 shows [redacted]. Figure 4 shows [redacted] Numerous other small cost components show similar cost variations that are not displayed here for brevity. Charts for four additional components are presented in the Appendix A and several additional ones are included in the backup to this report. These include such components as 75W AC adapters, thermal solution, antenna,

plastics, modem & cable, metal parts, keyboard, keyboard controller, inverter module, and others.

Figure 3

[redacted]

Figure 4

[redacted]

59. Manufacturers also change the quality of specific components to meet different retail price points. For example, Figure 5 shows [redacted]

60. This also illustrates a density of product offerings that comes close to mass customization: if a customer wants a better battery, it is available in what is otherwise the same product. The fixed prices underlying the Defendant's focal point hypothesis are meaningless when the density of focal point prices is great.[redacted]. If both are considered "focal price points," then focal price points do not place much constraint on price changes.

Figure 5

[redacted]

61. The trading-off of component quality to achieve a specific selling price is also evident in manufacturers' sales data. For example, Figure 6 [redacted]

62. [redacted][47] [redacted].[48]

63. [redacted].

[47] [redacted]

[48] [redacted]

[49] [redacted].

64. [redacted]. This demonstrates that manufacturers can and do make quality substitutions of various components, including batteries, if the price needs to remain constant.

65. Figure 7 [redacted]. Figure 8 [redacted]

66. Figure 6 through Figure 8 demonstrate [redacted]

Figure 6

[redacted]

Figure 7

[redacted]

Figure 8

[redacted]

B. Quality of LIBs Used in Finished Products is Negatively Related to Battery Costs

67. Though the quality of the LIB used in finished products is only one avenue for a quality response to elevated LIB prices, I investigate whether LIB quality used in products is related to battery price. Specifically, I explore whether the data suggests that lower but-for LIB cell prices would have led to the adoption of higher quality batteries and whether higher LIB cell prices lead to the use of lower quality batteries in finished products. I find that there is a statistical relationship between LIB cost and LIB quality (as indicated by cell capacity) indicating that higher LIB costs led to lower LIB quality in consumers' products.

68. Figure 9 addresses the relationship between Defendants' LIB cell capacities and their prices. The dashed teal line is the quarterly price for a hypothetical fixed-capacity (1,800 mAh) LIB cell derived by a regression of the log of LIB cell price on capacity and quarterly dummies. The black line is the maximum available cell capacity in each quarter. The latter represents the technological frontier for LIB cell quality. The red dashed line is the average cell capacity weighted by the number of units sold.[50]

69. The price of a battery with 1,800 mAh capacity illustrated in Figure 9 fell from around $4.3 in 2000 to $2.2 in 2013, interrupted by a couple of peaks associated with spikes in Cobalt prices illustrated in Figure 10. The estimated but-for world has a time series of battery prices everywhere below the battery prices in the actual world, illustrated in Figure 9. This but-for price series is about four percent below the actual before the Cobalt period (2000Q1 – 2007Q1), about 34 percent during the Cobalt period (2007Q2 – 2009Q4), and around 14 percent after the Cobalt period (2010Q1-2011Q2).

70. The impact of a permanent decline in battery prices on battery quality is evident in Figure 9. Corresponding with the long-term downward trend in constant capacity battery prices from $4.3 to $2.2 is the long-term upward

[50] In order to focus on the capacity aspect of quality, the data used in this analysis are restricted to 18650 cells and batteries with capacities lower than 1,400mAh are excluded after 2003. Batteries with lower capacities may have higher power and are used in power tools. See, Leamer Opening Report, 15.

trend in average capacity from 1,750 mAh in 2000 to 2,450 mAh in 2013. The but-for world can be thought as a shift leftward (except in the cobalt period) of the downward path of prices, and a corresponding shift leftward of the upward rise in quality, meaning that the potential quality improvement occurs earlier in the but-for world.

71. There is a short-run experiment evident in Figure 9 when battery prices are elevated during periods of cobalt price spikes. It also illustrates a relationship between battery prices and battery quality (capacity).[51] While there are no "valleys" of average battery capacity corresponding with the "mountains" of battery prices, the largest battery price spike does correspond with a slow-down in the rate of ascent in average battery capacity.

72. Figure 10 illustrates the cobalt prices going back to 1995 and includes a three-year moving average of these prices. Product design needs to be suited not to past cobalt prices but to future ones. The three-year moving average is a kind of price forecast which might be more relevant for product design than the highly variable actual prices. Vertical lines in this figure separate the periods in which the three-year average cobalt price was (a) falling until 2004 and (b) then rising until 2008, (c) then spiking up until 2010, (d) and spiking down until 2012 and (e) then falling again. In Figure 9, these are periods of (a) rising average capacity, (b) rising more slowly, (c) stagnant; and (d) little change in capacity and finally (e) rising capacity again.

73. The maximum available capacity of LIB cells between 2000Q1 and 2008Q3 (which was the peak of the cobalt period), rose from 1,800mAh to 2,600mAh. During this period, as cell prices were falling, the quantity-weighted average LIB cell capacity was steadily rising catching up to the line of the technological frontier with some gap. However, at the peak of the cobalt period there is a decrease and a flattening of the quantity-weighted average capacities sold while the available capacities keep rising at the previous pace. The gap after the cobalt period peak noticeably widens. This indicates that the demand shifted

[51] While capacity is the most important and easily measurable aspect of quality, an LIB has other quality aspects, such as energy density, power output, and voltage. Leamer Opening Report, 14-15.

away somewhat from the technological frontier towards lower available capacities.

74. The observed negative relationship between capacities used and the price of a capacity suggests that lower LIB prices, absent the conspiracy, would have led to the adoption of higher quality batteries even with focal point pricing.

Figure 9

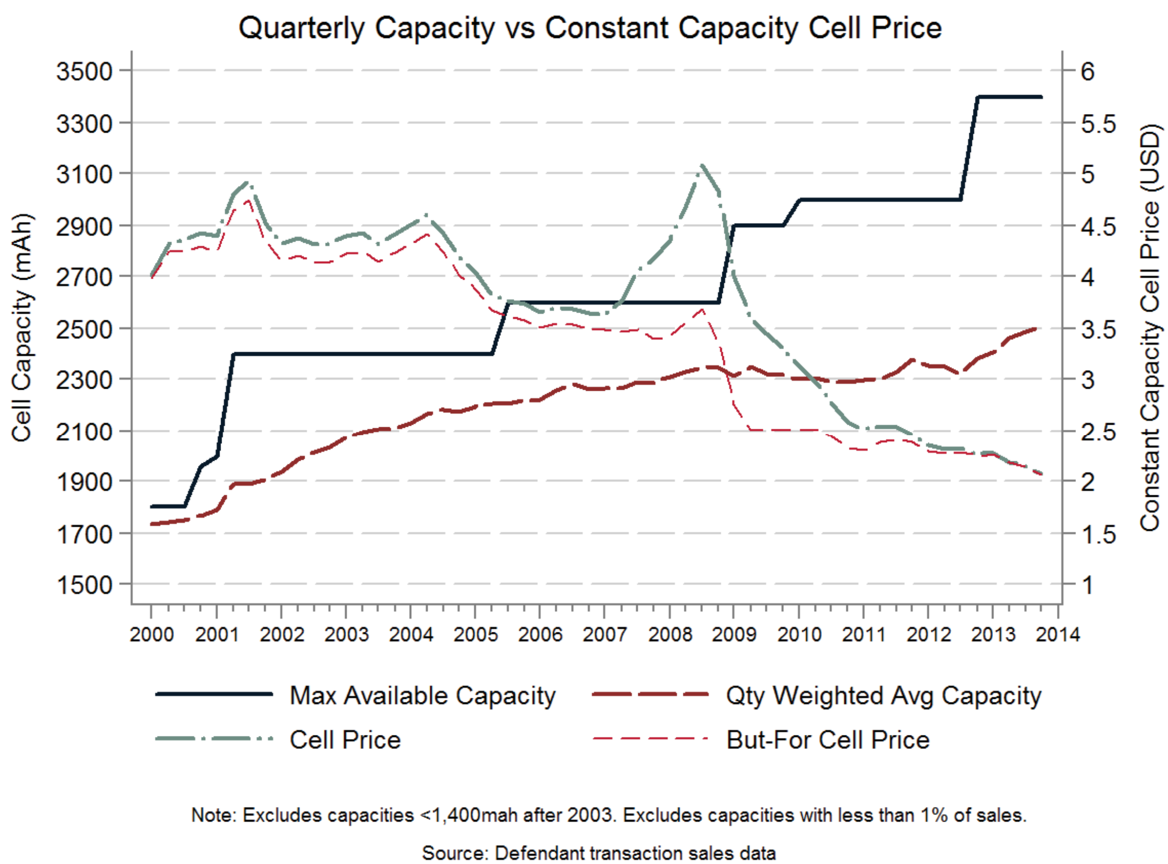
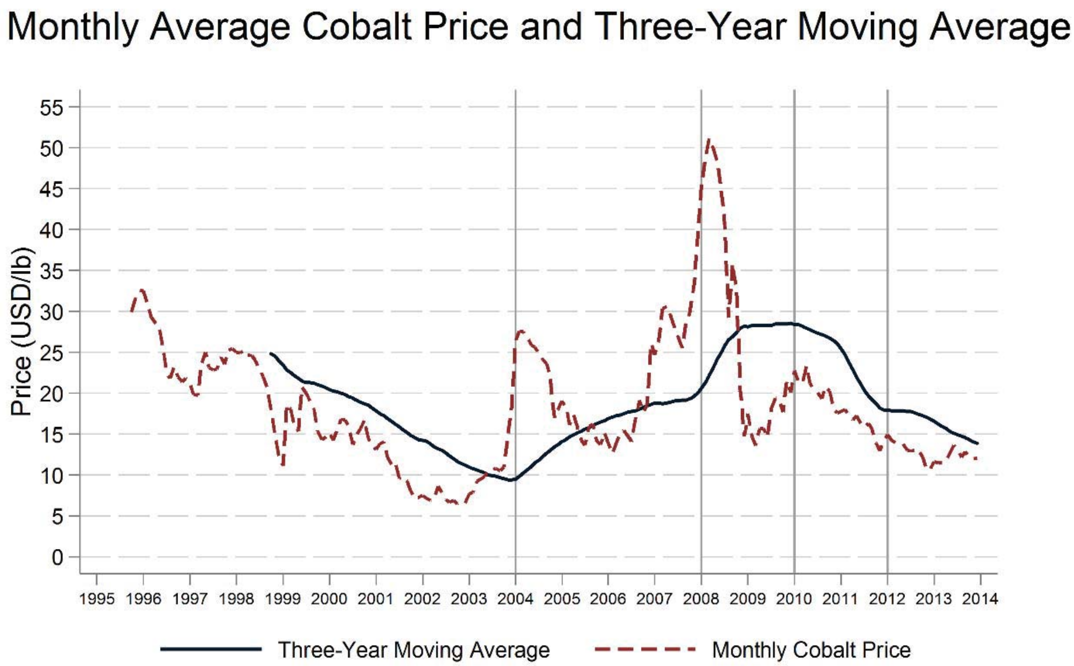


Figure 10



Source: London Metal Exchange Data from LGC-MDL0002342; P-DOJ0099116; minerals.usgs.gov

75. The changes in the use of different capacity batteries along with the LIB cell prices can also be observed in the batteries of notebooks sold in the market. Figure 11 shows [redacted] This is evidence that LIB quality (capacity) is impacted by elevated LIB prices.

Figure 11

[redacted]

C. Pass-through Rates During and Outside the Conspiracy Period Were Not Significantly Different Either Qualitatively or Statistically

76. I also study whether there is any evidence to support the argument that cost pass-through rates changed during the alleged conspiracy such that elevated LIB costs might not have impacted consumers. I do not find any evidence supportive of such a conclusion. Pass-through rates during and outside of the alleged conspiracy are statistically indistinguishable.

77. To examine the question, I perform a pass-through regression, reported in Figure 12, to test whether pass-through rates were different during the

conspiracy period and outside the conspiracy period.[52] As in my other pass-through regressions, the unit price of a finished product is regressed on the lagged unit price, unit cost, and lagged unit cost. Here, I also include a dummy for the conspiracy period and an interaction between this dummy and unit price and unit cost variables. These interactions estimate the difference between the pass-through rates during the conspiracy period and outside the conspiracy period. The long-run pass-through rates are presented at the bottom of the table which shows that there is no statistically significant difference between pass-through rates inside and outside of the conspiracy period.

78. In addition, I test whether long-run pass-through rates in and out of the conspiracy period are statistically equal to 100%. The results of the test, shown in rows 16 and 17, suggests that pass-through rates with and without conspiratorial overcharge are indeed statistically indistinguishable from 100%. Hence, there is no evidence to believe that cost increases with overcharges were not passed on to the prices of the finished products.

[52] Data outside the conspiracy period spans years 1997 - 1999 and 2011 – 2016 with varying coverage for different companies.

Figure 12

LIB Finished Product Pass-Through During and Outside of Conspiracy Period
Notebooks, Camcorders, and Power Tools

Dep. Var.: Unit Price

	Variable	Fixed Effects for Company-Product Type			Fixed Effects for Part Numbers		
	Variable	Coefficient	St Err	T-statistic	Coefficient	St Err	T-statistic
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
	Outside Conspiracy Pass-Through						
1	Unit Price (-1)	0 9263 ***	0 0150	61 6317	0 7903 ***	0 0664	11 8944
2	Unit Cost	0 7011 ***	0 1780	3 9382	0 6756 ***	0 2125	3 1784
3	Unit Cost (-1)	-0 6284 ***	0 1824	-3 4458	-0 4195 **	0 1918	-2 1871
	Difference Between Inside and Outside Conspiracy						
4	Conspiracy Indicator (Jan-2000 - Apr-2011) * Unit Price (-1)	-0 0719 ***	0 0164	-4 3835	-0 0949	0 0639	-1 4861
5	Conspiracy Indicator (Jan-2000 - Apr-2011) * Unit Cost	0 0274	0 1705	0 1605	0 0936	0 1738	0 5385
6	Conspiracy Indicator (Jan-2000 - Apr-2011) * Unit Cost (-1)	0 0511	0 1756	0 2908	-0 0057	0 1529	-0 0370
7	Constant	4 2097 ***	1 3660	3 0817	-12 3205	35 6629	-0 3455
8	Company-Product Type FEs	Yes					
9	Company-Product Type FEs * Conspiracy Indicator	Yes					
10	Part-Number FEs				Yes		
11	Quantity Weights	Yes			Yes		
12	Observations	284,528			284,528		
13	R-squared	0 99			0 99		
	Long-Run Pass-Through						
14	**Out of Conspiracy**	**0.9855 *****	**0.0685**	**14.3960**	**1.2209 *****	**0.3339**	**3.6564**
15	**In Conspiracy**	**1.0375 *****	**0.0271**	**38.2472**	**1.1290 *****	**0.1827**	**6.1811**
16	**(In Conspiracy) - (Out of Conspiracy)** *Row(13) - Row(14)*	**0.0520**	**0.0568**	**0.9155**	**-0.0919**	**0.1609**	**-0.5713**
	Hypothesis Test: Pass-Through=1						
17	**Out of Conspiracy Pass-Through=1** *Row(13) - 1*	**-0.0145**	**0.0685**	**-0.2119**	**0.2209**	**0.3339**	**0.6616**
18	**In Conspiracy Pass-Through=1** *Row(14) - 1*	**0.0375**	**0.0271**	**1.3826**	**0.1290**	**0.1827**	**0.7063**

Note: [1] Based on monthly average prices and costs by manufacturer part number or SKU
[2] Standard errors clustered at the Company-Product Type level
[3] Includes company-products with at least 7 months of data in the out-of-conspiracy period
[4] [redacted]
[5] Conspiracy Indicator is omitted from the analysis since it is collinear with Company-Product Type FEs * Conspiracy Indicator

Source: Defendant Sales Data; Third Party Sales Data

IV. The Extent to Which Focal Points Inhibit Price Competition is Overstated

79. Even when products are introduced at focal point retail prices, prices are not fixed at those focal points for long. This means that while pass-through of elevated LIB costs into quality at the point of design is one avenue for impact when focal point retail prices are prevalent, the avenue of LIB overcharge pass-through into prices is still available. Indeed, those focal point retail prices are not nearly as set-in-stone as has been claimed. For example, Figure 13 shows monthly average prices of notebooks (by SKU) sold by MEI[53] [redacted]. Figure 14 and Figure 15 show [redacted]

[53] Micro Electronics Inc. ("MEI") is the parent company of Micro Center, a computer and electronics retailer with over 30 retail locations. MEI provided transaction-level data of notebooks, cameras, and camcorders covering the period of 2008-2011. http://www.vault.com/company-profiles/general-consumer-products/micro-electronics,-inc/company-overview.aspx

Figure 13

[redacted]

Figure 14

[redacted]

Figure 15

[redacted]

80. The figures below show examples of average monthly prices and costs of several notebook SKUs sold by MEI [redacted].

81. These figures illustrate that [redacted]

Figure 16

[redacted]

Figure 17

[redacted]

Figure 18

[redacted]

Figure 19

[redacted]

V. Additional Battery Pass-Through Analysis

A. Pass-Through to LIB Packers

82. In my previous reports, I presented several analyses of pass-through to independent packers.[54] In one of these pass-through analyses, I utilized data on pack prices from Simplo Taiwan.[55] At the time, Simplo Taiwan data was available only for the period of 2006 through 2011. I have received additional data from Simplo Taiwan that includes sales from 2011 to 2017. Below, I update my previous analysis with this new data and present the results in Figure 20 and Figure 21. [redacted].

[54] Leamer Supplemental Report, 11-16; Leamer Supplemental Reply Report, 34-40.

[55] Leamer Supplemental Reply Report, 37-39.

Figure 20

[redacted]

Figure 21

[redacted]

B. Pass-Through of Battery Costs in Camcorders

83. In my opening report, I presented an analysis of battery cost pass-through in Toshiba notebooks.[56] I found that changes in battery costs are passed on to consumers in notebook prices and that the results are consistent with complete pass-through. Here, I present a similar analysis for Sony camcorders and my conclusion that battery costs are pass- through into finished product prices remains unchanged.

84. Sony produced datasets containing cost breakdowns for individual components, including batteries, used in camcorders from 2009 to 2013. I matched these battery costs with Sony camcorder prices and cost of goods sold

[56] Leamer Opening Report, 74-75; Leamer Reply Report, 72-74; Leamer Supplemental Reply Report, 67-68.

("COGS") in Sony's transactional sales data. The match is done by camcorder model code on a quarterly basis. As with the Toshiba notebook data, it is not possible to analyze inter-temporal effects within each camcorder model because the battery costs are predominantly constant within the life of each model. Hence, I analyze the relationship between battery costs and camcorder prices from the variability of battery types (e.g. different capacities) included in different notebook models (at the same or different points in time).

85. Figure 22 shows the results of this regression. The dependent variable is the weighted average price charged by Sony to its customers for a camcorder model. This price is regressed on the battery cost and the weighted average COGS of the camcorder less the battery cost. There are two distinct camcorder model types that start with "DCR" and "HDR" (High-Definition Recorder). I perform the pass-through regressions separately for these two types of models. [redacted]. The important takeaway, however, is that the data is consistent with a complete pass-through – it is not consistent with 0% pass-through. This is additional evidence of complete pass-through of all costs, including the battery.

Figure 22

[redacted]

VI. Damages

A. Overcharge Model

86. In my Opening Report, I presented a regression model for estimating damages to consumers.[57] To briefly recap, I used monthly data from January 1997 to December 2013 to estimate overcharges for both cylindrical cells and cylindrical cells in packs. The conspiracy effect operates through the elevated constant applicable to the period January 2000 through April 2011 and also through variables that capture how the pricing relationship of cylindrical LIB prices to cobalt prices changed during the period in which the cartel operated.[58]

87. A second indicator applicable to the period April 2007 through December 2009 interacts with cobalt prices to capture changed responsiveness to cobalt

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[57] Leamer Opening Report, 51-58.

[58] Leamer Opening Report, 55.

prices in this period. In addition, I include a binary indicator for this period. The model also includes the price of the battery lagged one month as an explanatory variable, the cobalt price lagged three months and six months, the producer price of portable PCs to capture the typical pace of technological improvement in the industry, and the "macro-economic" variables– housing starts and industrial production, which capture the Great Recession and other swings in aggregate demand. All variables are in logarithmic form.[59]

88. The model contains three variables that combine to determine the total estimated conspiracy effect. The overcharge percentages and amounts per cell implied by this model are found by "turning off" these variables. The combined effect is positive during the conspiracy period for both cylindrical LIB cells and cylindrical LIB cells sold in packs.[60]

89. In my subsequent Reply Report, I addressed concerns raised by the opposing expert with regards to my model.[61] One part of this response was to conduct multiple sensitivity regressions with different variables to check the robustness of my model.[62] In conclusion, I confirmed that my model of overcharges is a reliable way of estimating damages.

90. My conclusions have not changed. This model can also be used to reliably estimate damages to individual Plaintiffs. I present the results of the overcharge regression in Figure 23 below. These results differ from the ones presented in the Opening Report only to the extent that data updates have been made (e.g. NEC battery sales data was added after the Opening Report).[63]

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[59] Leamer Opening Report, 55-56.

[60] Leamer Opening Report, 56.

[61] Leamer Reply Report, 7-45.

[62] Leamer Reply Report, 41-45.

[63] This updated data is available in the backup to Leamer Reply Report of August 23, 2016.

Figure 23

Overcharge Regression with Cells and Packs

	Cells			Cells in Packs		
Variable	Coeff	T-Stat	P-Val	Coeff	T-Stat	P-Val
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable						
Log Price Per Cell [1]						
Conspiracy Indicator (Jan 2000-April 2011)[2]	0 0045 *	1 88	0 0606	0 0070 ***	5 31	0 0000
Alt Cobalt Sensitivity Period (April 2007-Dec 2009)[3]	-0 0514 ***	-3 15	0 0016	-0 0528 ***	-5 17	0 0000
Log Price Per Cell (-1)	0 8906 ***	152 93	0 0000	0 8832 ***	253 19	0 0000
Log Cobalt Price (-3) [4]	0 0443 ***	11 22	0 0000	0 0199 ***	8 42	0 0000
Log Cobalt Price (-6)	-0 0378 ***	-8 58	0 0000	-0 0080 ***	-3 02	0 0026
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0 0250 ***	4 57	0 0000	0 0238 ***	7 07	0 0000
Log Portable PC PPI [5]	0 0319 ***	10 42	0 0000	0 0240 ***	12 47	0 0000
Log Housing Starts (-1) [6]	0 0236 ***	3 49	0 0005	-0 0010	-0 22	0 8231
Log Housing Starts (-3)	-0 0328 ***	-4 70	0 0000	0 0027	0 60	0 5467
Log Industrial Production Index (-1) [7]	-0 0530	-0 76	0 4485	0 2156 ***	4 91	0 0000
Log Industrial Production Index (-3)	0 1561 **	2 23	0 0260	-0 2490 ***	-5 71	0 0000
Constant	-0 4999 ***	-3 83	0 0001	0 1417 *	1 71	0 0877
Fixed Effects	YES			YES		
Quantity Weights	YES			YES		
Observations	5,857			19,405		
R-squared	0 978			0 979		

Notes: [1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination

[2] Conspiracy Indicator takes the value one from January 2000-April 2011

[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009

[4] Monthly Cobalt Price /lb

[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers

[6] U S Annual Rate for Housing Units Starts

[7] U S Industrial Production Index

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

Source: Leamer Backup

B. Plaintiffs' Damages

91. Figure 24 has a list of Plaintiffs and a summary of their affected LIB purchases. There are 21 individual Plaintiffs and two cities who purchased various notebooks, camcorders, and power tools during the conspiracy period. In one of my previous reports, I identified the LIB cells that are contained in these products. I determined that the LIB cells were cylindrical and manufactured by

one of the Defendants.[64] A more detailed summary of the batteries contained in the plaintiff purchases was provided in a previous report.[65]

92. Using the results of the overcharge regression, I estimate an average per-cell overcharge on a monthly basis.

93. As for the appropriate pass-through of these overcharges, I concluded in my previous reports that the results of my analysis "support a pass-through rate of 100 percent or more."[66] First, I apply 100% pass-through rate to estimate plaintiff damages. Additionally, I estimate plaintiff damages using the pass-through regression estimates. I estimated sales-weighted average pass-through rates derived from my pass-through regressions – 160% and 136%.[67] I apply the lower of these two estimates to the damages calculations.

94. Plaintiff damages are estimated by multiplying the average per-cell overcharge by the number of purchased LIB cells and the appropriate pass-through rate. The total estimated damage suffered by these Plaintiffs is $1,511.66 using a 100% pass-through rate and $2,055.85 using a 136% pass-through rate.

[64] Leamer Reply Report, 98-102 and 115-120. Where adequate information was not available to determine cell manufacturer or type, I have assumed cylindrical cells manufactured by one the Defendants. This is based on the share of the Defendants among manufacturers and the share of cylindrical batteries among cell types in notebook battery sales. Defendants' combined market share of cylindrical cell sales during the class period was 93% and their average quarterly market share was 95%. (Leamer Reply Report, 85). Most notebook manufactures used cylindrical batteries in notebooks (Leamer Reply Report, Figure 32). Additionally, 6-cells, which I understand to be the most common pack size, was assumed in one case where number of cells could not be determined.

[65] Leamer Reply Report, 115-120.

[66] Leamer Supplemental Report, 60-61.

[67] Leamer Supplemental Report, 64.

Figure 24

Plaintiffs' Damages

Plaintiff	Purchase Date	Purchased Product	Units Purchased	Number of Defendant Cylindrical Cells Purchased	Overcharge per Cell [1]	Damages 100% Pass-Through	Damages 136% Pass-Through
					(Dollars)		
						(5)*(6)	(5)*(6)*1.36
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Piya Robert Rojanasathit	8/1/2009	Notebook	1	6	$ 1.01	$ 6.08	$ 8.27
Linda Lincoln	7/3/2005	Notebook	1	6	0.28	1.68	2.29
Donna Shawn	7/16/2006	Notebook	1	6	0.09	0.56	0.76
Jason Ames	6/28/2005	Power Tool	1	10	0.29	2.88	3.91
Jason Ames	11/22/2008	Camcorder	1	2	1.53	3.06	4.16
Christopher Hunt	9/5/2003	Notebook	1	8	0.28	2.21	3.01
John Kopp	8/20/2005	Notebook	1	6	0.28	1.67	2.27
Bradley Van Patten	10/7/2008	Notebook	1	6	1.41	8.44	11.48
Patrick McGuinness	around 2003 (approx.)	Camcorder	1	2	0.28	0.56	0.76
David Tolchin	1/2/2008	Notebook	1	6	0.57	3.40	4.62
David Tolchin	9/17/2009	Notebook	1	3	0.95	2.86	3.88
Joseph O'Daniel	12/28/2009	Notebook	1	6	0.83	4.99	6.79
Christopher Bessette	7/8/2007	Notebook	1	6	0.53	3.19	4.34
Steven Bugge	12/1/2010	Notebook	1	6	0.31	1.86	2.54
Tom Pham	9/18/2006	Notebook	1	6	0.26	1.56	2.13
Patrick McGuinness	1/25/2011	Notebook	1	6	0.30	1.82	2.47
Bradley Seldin	11/1/2008	Notebook	1	6	1.53	9.17	12.47
Cindy Booze	3/5/2007	Notebook	1	6	0.26	1.54	2.09
Matthew Ence	6/29/2005	Notebook	1	8	0.29	2.30	3.13
Caleb Batey	6/10/2010	Notebook	1	6	0.28	1.70	2.32
William Cabral	Approx. late 2007 to early 200[illegible]	Notebook	1	6	0.53	3.17	4.30
Matt Bryant	11/8/2009	Notebook	1	6	0.53	3.17	4.31
Caleb Batey	6/30/2005	Notebook	1	6	0.09	0.56	0.77
Drew Fennelly	Late 2010	Notebook	1	6	0.17	1.00	1.36
Sheri Harmon	Approx. July or August 2009	Notebook	1	6	0.65	3.88	5.27
City of Palo Alto	4/7/2004 - 9/14/2010	Notebook	144	864	0.60	520.38	707.71
City of Richmond	3/22/2005 - 12/28/2008	Notebook	203 [2]	1,512	0.61	917.98	1,248.45
Total				2,523		$ 1,511.66	$ 2,055.85

Notes: [1] Overcharges based on "Cells" regression used for non-defendant-made packs.
Overcharges based on "Cells in Packs" regression used for defendant-made packs.
[2] Additional battery packs purchased with notebooks are included as separate units.

Edward E. Leamer, Ph.D.
May 25, 2018

APPENDIX A. Small Cost Component Charts

[redacted]

[redacted]

Appendix B. Plaintiffs' Purchases

Class Representatives Purchases List

Plaintiffs	State	Purchase Date (Jan 1, 2000 – May 31, 2011)	Relevant Purchase [finished product]	Product Type	Cells per Pack	Battery Pack Manufacturer	Battery Cell Manufacturer	Cell Type & Cell Model Number
Piya Robert Rojanasathit	California	August 1, 2009	Dell Studio 15 laptop Dell Service Tag No. 2F5S7K1	Notebook	6	Sanyo JWPHF (IPP-ROJANASATHIT00000008A SANYO0432726)	Sanyo (SANYO0432726)	Cylindrical UR18650FM (SANYO0432726)
Linda Lincoln	West Virginia	July 3, 2005	Dell Inspiron 15 N5030 laptop Model No. iN5030-239983D Express Service Code: 34742437885 Dell Service Tag: FYKR0N1 Serial No. CN-0N7J7M-70166-0CS-07TQ-A00 (D P/N 0N7J7M))	Notebook	6	Sanyo J1KND (IPP-LINCOLN00000188A IPP-LINCOLN00000190A SANYO0432726)	Sanyo (SANYO0432726)	Cylindrical UR18650A (SANYO0432726)
Donna Shawn	Michigan	July 16, 2006	Dell Inspiron 1505 laptop Dell Service Tag No. 5MY7CB1 Serial No. CN-OKD882-48643-5139	Notebook	6	Simplo UD265 (Dell Website)	Panasonic or [redacted] SANYO0000226)	Cylindrical (SANYO0000226)
Jason Ames	Maine	June 28, 2005	Makita Cordless drill Model No. BDF452 Serial No. 0418165 Y	Power Tool	10	Sony 95% / Samsung 5% BL 1830 (Makita Website)	[redacted]	[redacted]
Jason Ames	Maine	November 22, 2008	Sony Mini DV camcorder Model No. DCR-HC96 Serial No. 190268759064	Camcorder	2	Sony NP-FP50 (Sony Website; [redacted]	[redacted]	[redacted]
Christopher Hunt	Arizona	September 5, 2003	Sony GRZ 660 laptop Model No. PCG-GRZ660 Serial No. 3105483	Notebook	8	Sony PCGA-BP2NX (Sony Website; [redacted]	[redacted]	[redacted]
John Kopp	Illinois	August 20, 2005	Dell Inspiron 6000 Dell Service Tag: 11S0981 Express Service Code: 2284289713 Serial No. JP-0C5447-42016-6BE-1069	Notebook	6	Sanyo F5133 (Dell Website)	Sanyo (SANYO0000243)	Cylindrical UR18650FK (SANYO0000243)
Bradley Van Patten	Wisconsin	October 7, 2008	Sony Vaio laptop (replacement battery) Model No. VGP-BPS9/B	Notebook	6	[redacted]	[redacted]	[redacted]
Patrick McGuinness	Florida	around 2003 (approx.)	Sony DCR-TRV103 camcorder Model No: DCR-TRV103 Battery Model No: NP-F330	Camcorder	2	Sony NP-F330 (Sony Website)	[redacted]	[redacted]
David Tolchin	New York	January 2, 2008	Dell Latitude D830 (Intel Core 2 Duo T7500) Dell Service Tag: 1J3DDF1 Express Service Code: 3331302445	Notebook	6	SIMPLO WN979 (Dell Website)	Sanyo (Dell Website; SANYO0437203)	Cylindrical UR18650F (SANYO0437203)
David Tolchin	New York	September 17, 2009	Dell Inspiron 10 1010 Mini laptop Dell Service Tag: H92VQK1 Express Service Code: 37554335281	Notebook	3	Samsung J654N (Dell Website)	[redacted]	[redacted]
Joseph O'Daniel	Missouri	December 28, 2009	HP-DV6 1355dxl laptop Model No. DV6 1355dx Product No. VM222UA#ABA Serial No. CNF9456HL9	Notebook	6	[redacted]	[redacted]	[redacted]

Class Representatives Purchases List

Plaintiffs	State	Purchase Date (Jan 1, 2000 – May 31, 2011)	Relevant Purchase [finished product]	Product Type	Cells per Pack	Battery Pack Manufacturer	Battery Cell Manufacturer	Cell Type & Cell Model Number
Christopher Bessette	South Dakota	July 8, 2007	Toshiba Satellite A215-S4757 laptop Model Name: A215-S4757 Part No. PSAEGU-01100U Serial No. 67357525K	Notebook	6	Panasonic PA3534U-1BRS (Toshiba Website; PANA-C000388523)	Panasonic (PANA-C000113415)	Cylindrical CGR18650CE (PANA-C000113415)
Steven Bugge	California	December 1, 2010	Toshiba Satellite L655-S5096 laptop Model Name: L655-S5096 Part No. PSK2CU-01Q01S Serial No. XA020001W	Notebook	6	Panasonic PA3818U-1BRS (Toshiba Website; PANA-C000126910)	Panasonic (PANA-C000126910)	Cylindrical CGR18650CGT NCR18650TC (PANA-C000126910)
Tom Pham	California	September 18, 2006	Dell XPS M1210 Intel Core 2 Duo Processor T5600 laptop Model No. XPS M1210 MXC062 Dell Service Tag: HRX6TB1 Express Service Code: 38693631709	Notebook	6	SDI YF093 (Dell Website)	[redacted]	[redacted]
Patrick McGuinness	Florida	January 25, 2011	Sony Vaio laptop Model no. WFW9700VA01 Serial no. HLY0207096 Service Tag: C606Q31U	Notebook	6	SONY VGP-BPS22 or VGP-BPS22A (Sony Website; IPP-MCGUINNESS00000010A; [redacted]	[redacted]	Cylindrical [redacted]
Bradley Seldin	Florida	November 1, 2008	Acer Aspire 1410-2099 laptop Model No. ZH7 Serial No. 93703112025	Notebook	6	Panasonic CGR-B/6P3 (IPP-SELDIN00000002A)	Panasonic (PANA-C000038788E)	Cylindrical CGR18650CG (PANA-C000038788E)
Cindy Booze	Nebraska	March 5, 2007	Toshiba Satellite A135-S4467 laptop Model Name: A135-S4467 Part No. PSAD0U-03M00P Serial No. 17237434K	Notebook	6	Panasonic PA3465U-1BRS (Toshiba Website; PANA-C000388523)	Panasonic (PANA-C000113415)	Cylindrical CGR18650CE (PANA-C000113415)
Matthew Ence	Nevada	June 29, 2005	Toshiba Satellite L35-S2174 laptop Model Name: L35-S2174 Part No. PSL33U-02601W	Notebook	8	Panasonic PA3506U-1BRS (Toshiba Website; PANA-C000388523)	Panasonic (PANA-C000113415)	Cylindrical CGR18650CE (PANA-C000113415)
Caleb Batey	Tennessee	June 10, 2010	Asus G60JX laptop Model No. G60JX Serial No. A2N0AS143968067	Notebook	6			Cylindrical
William Cabral	Massachusetts	Approx. late 2007 to early 2008	HP Pavilion dv4-1435dx laptop Model Name. dv4-1435dx Product No. NU987UA#ABA Serial No. CND 92208007	Notebook	6			Cylindrical
Matt Bryant	New York	November 8, 2009	HP laptop G60-549DX Model No. G60-549DX Product No. VY794UA#ABA Serial No. (S)2CE94137N6	Notebook	6			Cylindrical
Caleb Batey	Tennessee	June 30, 2005	Toshiba Satellite M305D-S4840 laptop Model Name: M305D-S4840 Part No. PSMDYU-00J005 Serial No. 98115290W	Notebook	6			Cylindrical
Drew Fennelly	Kansas	Late 2010	HP G62 Laptop - Replacement Battery	Notebook	6			Cylindrical
Sheri Harmon	Oregon	Approx. July or August 2009	HP Laptop	Notebook	6			Cylindrical

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HCTC071	LATITUDE D810	March 22, 2005	SANYO	D5505	9	UR18650F	Cylindrical	SANYO
F729B71	LATITUDE D810	April 29, 2005	SANYO	D5505	9	UR18650F	Cylindrical	SANYO
5457T71	INSPIRON 9300	July 6, 2005	SANYO	C5447	9	UR18650F	Cylindrical	SANYO
8CS8T71	LATITUDE D810	July 6, 2005	SONY	C5340	9	US18650G7	Cylindrical	SONY
1089T71	INSPIRON 6000	July 7, 2005	SANYO	F5133	6	UR18650F	Cylindrical	SANYO
D4S4T71	LATITUDE D810	July 7, 2005	SONY	C5340	9	US18650G7	Cylindrical	SONY
54S4T71	LATITUDE D810	July 7, 2005	SONY	C5340	9	US18650G7	Cylindrical	SONY
73Q3981	INSPIRON 600M	August 25, 2005	SANYO	Y1338	6	UR18650F	Cylindrical	SANYO
J2Q3981	INSPIRON 600M	August 25, 2005	SANYO	Y1338	6	UR18650F	Cylindrical	SANYO
6LVZK81	INSPIRON 9300	October 3, 2005	SANYO	C5447	9	UR18650F	Cylindrical	SANYO
572QL81	LATITUDE D610	October 7, 2005	SANYO	Y1338	6	UR18650F	Cylindrical	SANYO
8XLP191	INSPIRON 9300	December 23, 2005	SONY	C5446	9	US18650G7	Cylindrical	SONY
41V9K91	LATITUDE D610	March 1, 2006	SONY	C2603	6	US18650G7	Cylindrical	SONY
B0V9K91	LATITUDE D610	March 1, 2006	SONY	C2603	6	US18650G7	Cylindrical	SONY
50V9K91	LATITUDE D610	March 1, 2006	SONY	C2603	6	US18650G7	Cylindrical	SONY
2DC7R91	LATITUDE D610	April 5, 2006	SANYO	Y1338	6	UR18650F	Cylindrical	SANYO
1HC7R91	LATITUDE D610	April 5, 2006	SANYO	Y1338	6	UR18650F	Cylindrical	SANYO
6FC7R91	LATITUDE D610	April 5, 2006	SANYO	Y1338	6	UR18650F	Cylindrical	SANYO
CS64NB1	LATITUDE D620	August 23, 2006	PANASONIC	JD606	6	CGR18650E	Cylindrical	PANASONIC
19DVNB1	LATITUDE D620	August 28, 2006	PANASONIC	JD606	6	CGR18650E	Cylindrical	PANASONIC
1ZTWZB1	LATITUDE D620	October 24, 2006	SANYO	JD605	6	UR18650F	Cylindrical	SANYO
8YTWZB1	LATITUDE D620	October 24, 2006	SANYO	JD605	6	UR18650F	Cylindrical	SANYO
3XTWZB1	LATITUDE D620	October 24, 2006	SANYO	JD605	6	UR18650F	Cylindrical	SANYO
9BKBFC1	LATITUDE D620	January 27, 2007	PANASONIC	JD606	6	CGR18650E	Cylindrical	PANASONIC
6NKBFC1	LATITUDE D620	January 27, 2007	PANASONIC	JD606	6	CGR18650E	Cylindrical	PANASONIC
B9KBFC1	LATITUDE D620	January 27, 2007	PANASONIC	JD606	6	CGR18650E	Cylindrical	PANASONIC
9LKBFC1	LATITUDE D620	January 27, 2007	PANASONIC	JD606	6	CGR18650E	Cylindrical	PANASONIC
3Z4TFC1	LATITUDE D620	January 30, 2007	SANYO	JD605	6	UR18650F	Cylindrical	SANYO
GY4TFC1	LATITUDE D620	January 30, 2007	SANYO	JD605	6	UR18650F	Cylindrical	SANYO
4Y4TFC1	LATITUDE D620	January 30, 2007	SANYO	JD605	6	UR18650F	Cylindrical	SANYO
HVWYYC1	LATITUDE D620	May 18, 2007	SANYO	JN146	9	UR18650F	Cylindrical	SANYO
1Q56HD1	LATITUDE D531	August 19, 2007	SANYO	MM158	6	UR18650F	Cylindrical	SANYO
F89MHD1	PRECISION M90	August 24, 2007	SANYO	C5447	9	UR18650F	Cylindrical	SANYO
6RXVHF1	LATITUDE D630 ATG	January 21, 2008	SANYO	NT377	6	UR18650F	Cylindrical	SANYO
92YYLF1	PRECISION M6300	February 10, 2008	SANYO	C5447	9	UR18650F	Cylindrical	SANYO
9RN8MF1	LATITUDE D520	February 14, 2008	SANYO	TT710	6	UR18650F	Cylindrical	SANYO
DRN8MF1	LATITUDE D520	February 14, 2008	SANYO	TT710	6	UR18650F	Cylindrical	SANYO
JRN8MF1	LATITUDE D520	February 14, 2008	SANYO	TT710	6	UR18650F	Cylindrical	SANYO

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FRN8MF1	LATITUDE D520	February 14, 2008	SANYO	TT710	6	UR18650F	Cylindrical	SANYO
FF2SQF1	PRECISION M6300	February 25, 2008	SANYO	C5447	9	UR18650F	Cylindrical	SANYO
8WZ5SF1	LATITUDE D630	March 5, 2008	SONY	KP428	6	US18650G8AC	Cylindrical	SONY
7WZ5SF1	LATITUDE D630	March 5, 2008	SONY	KP428	6	US18650G8AC	Cylindrical	SONY
H35V1G1	LATITUDE D630	April 17, 2008	SANYO	KP422	9	UR18650F	Cylindrical	SANYO
JT3K4G1	LATITUDE D530	April 25, 2008	SANYO	TT710	6	UR18650F	Cylindrical	SANYO
H88XDG1	PRECISION M6300	June 6, 2008	SANYO	C5447	9	UR18650F	Cylindrical	SANYO
FFRXLG1	LATITUDE D530	June 18, 2008	SANYO	TT710	6	UR18650F	Cylindrical	SANYO
5W71YG1	LATITUDE D530	August 3, 2008	SANYO	TT710	6	UR18650F	Cylindrical	SANYO
9W71YG1	LATITUDE D530	August 3, 2008	SANYO	TT710	6	UR18650F	Cylindrical	SANYO
1JB9NH1	LATITUDE D630	October 28, 2008	SANYO	KP422	9	UR18650F	Cylindrical	SANYO
2GLHRH1	LATITUDE E6500	November 30, 2008	PANASONIC	FU441	9	CGR18650EA	Cylindrical	PANASONIC
JW16XH1	LATITUDE D630	December 28, 2008	SANYO	NT377	6	UR18650F	Cylindrical	SANYO
3X16XH1	LATITUDE D630	December 28, 2008	SANYO	NT377	6	UR18650F	Cylindrical	SANYO
H7GQYH1	LATITUDE E6500	January 18, 2009	SAMSUNG	MP494	9		Cylindrical	Defendant
FT436J1	LATITUDE E6500	February 6, 2009	SAMSUNG	MP494	9		Cylindrical	Defendant
JJFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
6JFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
DJFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
8JFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
FKFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
HJFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
5JFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
BHFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
3MFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
GJFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
BJFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
9HFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
HHFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
3JFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
1KFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
4HFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
GNFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
JGFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
CJFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
BLFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
DHFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
9JFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant

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4LFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
CHFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
6KFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
3KFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
3HFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
6HFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
GHFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
5HFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
FJFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
JHFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
HMFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
7JFMBK1	LATITUDE E6500	June 29, 2009	SAMSUNG	PT436	6		Cylindrical	Defendant
HNF3TK1	LATITUDE E6500	August 19, 2009	SAMSUNG	MP494	9		Cylindrical	Defendant
87BM491	LATITUDE D610	January 13, 2006	SAMSUNG	C2451	6		Cylindrical	Defendant
37BM491	LATITUDE D610	January 13, 2006	SAMSUNG	C2451	6		Cylindrical	Defendant
57BM491	LATITUDE D610	January 13, 2006	SAMSUNG	C2451	6		Cylindrical	Defendant
7Y5S8B1	LATITUDE D620	July 7, 2006	SIMPLO	GD775	6	LGC2600 / SDI2600	Cylindrical	LGC / SDI
7Y5S8B1	LATITUDE D620	July 7, 2006	SAMSUNG	UG260	6		Cylindrical	Defendant
516S8B1	LATITUDE D620	July 7, 2006	SIMPLO	GD775	6	LGC2600 / SDI2600	Cylindrical	LGC / SDI
516S8B1	LATITUDE D620	July 7, 2006	SAMSUNG	UG260	6		Cylindrical	Defendant
9Y5S8B1	LATITUDE D620	July 7, 2006	SIMPLO	GD775	6	LGC2600 / SDI2600	Cylindrical	LGC / SDI
9Y5S8B1	LATITUDE D620	July 7, 2006	SAMSUNG	UG260	6		Cylindrical	Defendant
726S8B1	LATITUDE D620	July 7, 2006	SIMPLO	GD775	6	LGC2600 / SDI2600	Cylindrical	LGC / SDI
726S8B1	LATITUDE D620	July 7, 2006	SAMSUNG	UG260	6		Cylindrical	Defendant
4GG6CB1	LATITUDE D820	July 19, 2006	SIMPLO	YD623	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
CGG6CB1	LATITUDE D820	July 19, 2006	SIMPLO	YD623	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
5GG6CB1	LATITUDE D820	July 19, 2006	SIMPLO	YD623	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
6GG6CB1	LATITUDE D820	July 19, 2006	SIMPLO	YD623	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
8GG6CB1	LATITUDE D820	July 19, 2006	SIMPLO	YD623	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI

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BGG6CB1	LATITUDE D820	July 19, 2006	SIMPLO	YD623	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
798TLB1	LATITUDE D620	August 12, 2006	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
5B8TLB1	LATITUDE D620	August 12, 2006	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
G3393C1	LATITUDE D820	November 17, 2006	SIMPLO	YD623	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
BTCGLC1	LATITUDE D620	February 26, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
4SCGLC1	LATITUDE D620	February 26, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
4VCGLC1	LATITUDE D620	February 26, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
DSCGLC1	LATITUDE D620	February 26, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
DVCGLC1	LATITUDE D620	February 26, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
5V7KNC1	LATITUDE D620	March 12, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
4NCFVC1	LATITUDE D620	April 22, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
7PN8YC1	LATITUDE D620	May 12, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
5PN8YC1	LATITUDE D620	May 12, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
BPN8YC1	LATITUDE D620	May 12, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
CPN8YC1	LATITUDE D620	May 12, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
GPN8YC1	LATITUDE D620	May 12, 2007	SIMPLO	PD685	9	LGC2600 / SDI2600	Cylindrical	LGC / SDI
JFMV3D1	LATITUDE D620	June 21, 2007	SIMPLO	GD775	6	LGC2600 / SDI2600	Cylindrical	LGC / SDI
GFMV3D1	LATITUDE D620	June 21, 2007	SIMPLO	GD775	6	LGC2600 / SDI2600	Cylindrical	LGC / SDI
FLR5GF1	LATITUDE D630	January 11, 2008	SAMSUNG	NT394	6		Cylindrical	Defendant
GLR5GF1	LATITUDE D630	January 11, 2008	SAMSUNG	NT394	6		Cylindrical	Defendant

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79B8XH1	LATITUDE E6500	December 28, 2008	DYNAPACK	PT650	9		Cylindrical	Defendant
7WYB1J1	LATITUDE E6500	January 26, 2009	SIMPLO	MP492	9		Cylindrical	Defendant
B84B6J1	LATITUDE D630	February 9, 2009	SIMPLO	DU139	9		Cylindrical	Defendant
J1VB6J1	LATITUDE D630	February 9, 2009	SIMPLO	DU139	9		Cylindrical	Defendant
48FML81	LATITUDE D810	October 7, 2005	SIMPLO	D5540	9		Cylindrical	Defendant
1SF6Z81	INSPIRON 9300	December 12, 2005	SIMPLO	D5551	9		Cylindrical	Defendant
1S9R591	INSPIRON 9300	January 14, 2006	SIMPLO	D5551	9		Cylindrical	Defendant
1S9R591	INSPIRON 9300	January 14, 2006	SANYO	F5126	9		Cylindrical	Defendant
7S24691	INSPIRON 9300	January 16, 2006	SIMPLO	D5551	9		Cylindrical	Defendant
7S24691	INSPIRON 9300	January 16, 2006	SANYO	F5126	9		Cylindrical	Defendant
BQ24691	INSPIRON 9300	January 16, 2006	SIMPLO	D5551	9		Cylindrical	Defendant
BQ24691	INSPIRON 9300	January 16, 2006	SANYO	F5126	9		Cylindrical	Defendant
7R24691	INSPIRON 9300	January 16, 2006	SIMPLO	D5551	9		Cylindrical	Defendant
7R24691	INSPIRON 9300	January 16, 2006	SANYO	F5126	9		Cylindrical	Defendant
FCVNWB1	LATITUDE D620	October 3, 2006	SIMPLO	JD610	6		Cylindrical	Defendant
6F6FPD1	LATITUDE D630	September 16, 2007	SIMPLO	DU139	9		Cylindrical	Defendant
6F6FPD1	LATITUDE D630	September 16, 2007	SIMPLO	NT367	9		Cylindrical	Defendant
9SR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	DU139	9		Cylindrical	Defendant
9SR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	NT367	9		Cylindrical	Defendant
5VR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	DU139	9		Cylindrical	Defendant
5VR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	NT367	9		Cylindrical	Defendant
1TR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	DU139	9		Cylindrical	Defendant
1TR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	NT367	9		Cylindrical	Defendant
D8P7RD1	LATITUDE D630	September 27, 2007	SIMPLO	DU139	9		Cylindrical	Defendant
D8P7RD1	LATITUDE D630	September 27, 2007	SIMPLO	NT367	9		Cylindrical	Defendant
6TR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	DU139	9		Cylindrical	Defendant
6TR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	NT367	9		Cylindrical	Defendant
JTR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	DU139	9		Cylindrical	Defendant
JTR7RD1	LATITUDE D630	September 27, 2007	SIMPLO	NT367	9		Cylindrical	Defendant
FMSBWD1	LATITUDE D630 ATG	October 8, 2007	SIMPLO	DU139	9		Cylindrical	Defendant
FMSBWD1	LATITUDE D630 ATG	October 8, 2007	SIMPLO	NT367	9		Cylindrical	Defendant
4J88LF1	LATITUDE D630	February 4, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
4J88LF1	LATITUDE D630	February 4, 2008	SIMPLO	NT367	9		Cylindrical	Defendant
BJ88LF1	LATITUDE D630	February 4, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
BJ88LF1	LATITUDE D630	February 4, 2008	SIMPLO	NT367	9		Cylindrical	Defendant
CB6LYF1	LATITUDE D630	March 29, 2008	SIMPLO	KP433	6		Cylindrical	Defendant
9B6LYF1	LATITUDE D630	March 29, 2008	SIMPLO	KP433	6		Cylindrical	Defendant
8SPYFG1	LATITUDE D630	June 11, 2008	SIMPLO	DU139	9		Cylindrical	Defendant

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BPLZFG1	LATITUDE D630	June 11, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
BPLZFG1	LATITUDE D630	June 11, 2008	SIMPLO	NT362	9		Cylindrical	Defendant
FPLZFG1	LATITUDE D630	June 11, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
FPLZFG1	LATITUDE D630	June 11, 2008	SIMPLO	NT362	9		Cylindrical	Defendant
FLYTMG1	LATITUDE D630	June 23, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
2LYTMG1	LATITUDE D630	June 23, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
JKYTMG1	LATITUDE D630	June 23, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
4KYTMG1	LATITUDE D630	June 23, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
14BXMG1	LATITUDE D630	June 23, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
14BXMG1	LATITUDE D630	June 23, 2008	SIMPLO	NT362	9		Cylindrical	Defendant
B7T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
48T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
77T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
H7T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
G7T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
97T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
28T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
D7T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
B8T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
88T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
58T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
98T3DH1	LATITUDE D630	September 5, 2008	SIMPLO	DU139	9		Cylindrical	Defendant
FHTHNH1	LATITUDE E6500	October 31, 2008	DYNAPACK	PT650	9		Cylindrical	Defendant
BBS3RJ1	LATITUDE 2100	June 10, 2009	SIMPLO	4H636	6		Cylindrical	Defendant
BBS3RJ1	LATITUDE 2100	June 10, 2009	SIMPLO	J022N	6		Cylindrical	Defendant
6X3B8K1	LATITUDE 2100	September 6, 2009	SIMPLO	4H636	6		Cylindrical	Defendant
6X3B8K1	LATITUDE 2100	September 6, 2009	SIMPLO	J022N	6		Cylindrical	Defendant
7X3B8K1	LATITUDE 2100	September 6, 2009	SIMPLO	4H636	6		Cylindrical	Defendant
7X3B8K1	LATITUDE 2100	September 6, 2009	SIMPLO	J022N	6		Cylindrical	Defendant
HW3B8K1	LATITUDE 2100	September 6, 2009	SIMPLO	4H636	6		Cylindrical	Defendant
HW3B8K1	LATITUDE 2100	September 6, 2009	SIMPLO	J022N	6		Cylindrical	Defendant
JW3B8K1	LATITUDE 2100	September 6, 2009	SIMPLO	4H636	6		Cylindrical	Defendant
JW3B8K1	LATITUDE 2100	September 6, 2009	SIMPLO	J022N	6		Cylindrical	Defendant
BXTRQK1	INSPIRON MINI 10	September 20, 2009	DYNAPACK	H771N	6		Cylindrical	Defendant
HXTRQK1	INSPIRON MINI 10	September 20, 2009	DYNAPACK	H771N	6		Cylindrical	Defendant
1CLSQK1	INSPIRON MINI 10	September 21, 2009	SIMPLO	H769N	6		Cylindrical	Defendant
DBSTQK1	INSPIRON MINI 10	September 23, 2009	SIMPLO	H769N	6		Cylindrical	Defendant
CBSTQK1	INSPIRON MINI 10	September 23, 2009	SIMPLO	H769N	6		Cylindrical	Defendant

City of Richmond Dell Laptops Purchased Between 2005 and 2009

Service Tag	Brand Descripton	Ship Date	Battery Pack Manufacturer	Dell's Battery Part Number	Cells per Pack	Cell Model	Cell Type	Cell Manufacturer
41RDWK1	LATITUDE 2100	October 4, 2009	SAMSUNG	6P147	6		Cylindrical	Defendant
CCG9RK1	INSPIRON MINI 10	October 25, 2009	SIMPLO	H769N	6		Cylindrical	Defendant

Laptop Purchases by the City of Palo Alto from 2004 through 2011

Finished Product Model	Laptop Part Number	Purchase Date	Quantity	Battery Pack Model Number	Number of cells	Battery Pack Manufacturer	Battery Cell Model Number	Battery Cell Manufacturer	Battery Type
Toshiba Tecra M11-S3440	PTME3U-01300Q	9/14/2010	20	PA3788U-1BRS	6	Sanyo	3UR18650F-2-TBO3B	Sanyo	Cylindrical
Toshiba Portege R700-S1310	PT310U-01Q01Q	9/14/2010	12	PA3832U-1BRS	6	Panasonic	NCR18650AB	Panasonic	Cylindrical
Toshiba Tecra M9-S5515	PTM91U-03501T	6/19/2008	40	PA3588U-1BRS	6	Sanyo	3UR18650F-2TBO1U	Sanyo	Cylindrical
Toshiba Satellite M30 (Satellite M30-S309, Satellite M30-S3091, M30 Small Business Series)	PSM30U-0QKJ18 PSM30U-0QKJ19 PSM30U-0QKJ18S	5/27/2004	1	PA3331U-BRS	6	SONY	US18650G	SONY	Cylindrical
Toshiba Portege M400-ST9113	PPM40U-1V700D	4/3/2006	1	PA3191U-5BRS	6	SONY	US18650G7FB	SONY	Cylindrical
Toshiba Portege R700-S1320	PT311U-00J00U	9/14/2010	10	PA3832U-1BRS	6	Panasonic	NCR18650AB	Panasonic	Cylindrical
Toshiba Tecra A10-ST9010	PTSB3U-0FM00W	1/15/2009	2	PA3588U-1BRS	6	Sanyo	3UR18650F-2TBO1U	Sanyo	Cylindrical
Toshiba Tecra R840-S8420	PT42GU-008001	6/21/2006	30	PA3929U-1BRS	6	Sanyo	NCR18650AD	Sanyo	Cylindrical
Toshiba Tecra M2	PTM20U-002L27 PTM20U-004827 PTM20U-00CSR7	4/7/2004	1	PA3356U-1BRS	6	SONY	US18650G	SONY	Cylindrical
Toshiba Tecra M6 (Tecra M6-EZ6611)	PTM60U-003001	4/21/2007	6	PA3356U-2BRS	6	SONY	US18650G	SONY	Cylindrical
Toshiba Satellite M30 (Satellite M30-S309, Satellite M30-S3091, M30 Small Business Series)	PSM30U-0QKJ18 PSM30U-0QKJ19 PSM30U-0QKJ18S	8/25/2004	1	PA3331U-BRS	6	SONY	US18650G	SONY	Cylindrical
Toshiba Tecra M6 (Tecra M6-EZ6611)	PTM60U-003001	7/5/2007	20	PA3356U-2BRS	6	SONY	US18650G	SONY	Cylindrical

5/25/2018

Exhibit 1
List of Additional Materials Relied Upon

Pleadings and Orders	**Date**
Order Denying IPPs' Renewed Motion for Class Certification; Granting Motion to Strike Expert Report of Edward E. Leamer, Ph.D.	03/05/18
Expert Reports	
Leamer, Edward E.	11/21/17
Depositions	
[redacted]	[redacted]
Correspondence	**Date**
SONY	
Letter from Jon F. Cieslak to Lin Chan	04/23/18
Letter from Jon F. Cieslak to Lin Chan	05/10/18
Exhibits	
Letter from Jon F. Cieslak (Appendix A - Model Names.xlsx)	05/10/18
Documents	
[redacted]	

[redacted] [redacted]

Exhibit 1
List of Additional Materials Relied Upon

Publicly Available Materials

Andreu Mas-Colell, Michael D. Whinston and Jerry R. Green, *Microeconomic Theory*, (Oxford University Press, 1995).
Arnold C. Harberger, "The Measurement of Waste," *The American Economic Review* 54, no. 3 (May, 1964).
Federal Reserve Bank of St. Louis, "Producer Price Index by Industry: Electronic Computer Manufacturing: Portable Computers, Laptops, PDAs and Other Single User Computers," https://fred.stlouisfed.org/series/PCU33411133411172.
Hal R. Varian, *Intermediate Microeconomics: A Modern Approach*, 8th ed., (W. W. Norton & Company, 2010)
Passmark, "CPU Benchmarks - List of Benchmarked CPU's," https://www.cpubenchmark.net/cpu_list.php.

http://www.dell.com/support/home/us/en/4
http://www.ibatterys.com/sony-npfh40-digital-cameracamcorder-battery-replacement-p-49866.html?cPath=46782_60745
http://www.vault.com/company-profiles/general-consumer-products/micro-electronics,-inc/company-overview.aspx
https://docs.sony.com/release//DSC-QX10_QX100_brochure.pdf
https://support.hp.com/us-en/document/c01764354
https://support.hp.com/us-en/document/c01893242
https://support.hp.com/us-en/document/c01911134
https://support.hp.com/us-en/document/c02215919
https://support.toshiba.com/
https://www.cnet.com/products/
https://www.google.com/shopping/product/
https://www.newegg.com/Product/Product.aspx?Item=14R-00D3-01W66
https://www.pcmag.com/encyclopedia/term/44193/heat-sink

Data

Sony

SONY_LIB_DATA_25882		
SONY_LIB_DATA_25943		
SONY_LIB_DATA_25987	-	SONY_LIB_DATA_25988
SONY_LIB_DATA_25990	-	SONY_LIB_DATA_25993
SONY_LIB_DATA_26054		
SONY_LIB_DATA_26057	-	SONY_LIB_DATA_26070
SONY_LIB_DATA_26072	-	SONY_LIB_DATA_26075
SONY_LIB_DATA_26093	-	SONY_LIB_DATA_26104

Exhibit 1
List of Additional Materials Relied Upon

SONY_LIB_DATA_26137		
SONY_LIB_DATA_26139		
SONY_LIB_DATA_26142	-	SONY_LIB_DATA_26149
SONY_LIB_DATA_26162		
SONY_LIB_DATA_26166		
SONY_LIB_DATA_26201	-	SONY_LIB_DATA_26214
SONY_LIB_DATA_26217	-	SONY_LIB_DATA_26221
SONY_LIB_DATA_26224		
SONY_LIB_DATA_26226	-	SONY_LIB_DATA_26227
SONY_LIB_DATA_26229	-	SONY_LIB_DATA_26231
SONY_LIB_DATA_26233	-	SONY_LIB_DATA_26237
SONY_LIB_DATA_26239	-	SONY_LIB_DATA_26246
SONY_LIB_DATA_26248	-	SONY_LIB_DATA_26250
SONY_LIB_DATA_26258	-	SONY_LIB_DATA_26266
SONY_LIB_DATA_26270	-	SONY_LIB_DATA_26275
SONY_LIB_DATA_26280	-	SONY_LIB_DATA_26291
SONY_LIB_DATA_26294	-	SONY_LIB_DATA_26295
SONY_LIB_DATA_26297	-	SONY_LIB_DATA_26302
SONY_LIB_DATA_26306	-	SONY_LIB_DATA_26307
SONY_LIB_DATA_26309	-	SONY_LIB_DATA_26316
SONY_LIB_DATA_26319	-	SONY_LIB_DATA_26322
SONY_LIB_DATA_26325	-	SONY_LIB_DATA_26326
SONY_LIB_DATA_26328	-	SONY_LIB_DATA_26329
SONY_LIB_DATA_26332	-	SONY_LIB_DATA_26340
SONY_LIB_DATA_26342	-	SONY_LIB_DATA_26353
SONY_LIB_DATA_26356	-	SONY_LIB_DATA_26371
SONY_LIB_DATA_26375	-	SONY_LIB_DATA_26385
SONY_LIB_DATA_26387	-	SONY_LIB_DATA_26394
SONY_LIB_DATA_26396	-	SONY_LIB_DATA_26401
SONY_LIB_DATA_26404	-	SONY_LIB_DATA_26411
SONY_LIB_DATA_26415	-	SONY_LIB_DATA_26419
SONY_LIB_DATA_26421		
SONY_LIB_DATA_26423	-	SONY_LIB_DATA_26430
SONY_LIB_DATA_26433	-	SONY_LIB_DATA_26435
SONY_LIB_DATA_26437	-	SONY_LIB_DATA_26438
SONY_LIB_DATA_26440		

Exhibit 1
List of Additional Materials Relied Upon

Toshiba

TSB-LIB-00001849	-	TSB-LIB-00001850
TSB-LIB-00021570		
TSB-LIB-00082464	-	TSB-LIB-00082465
TSB-LIB-00139704	-	TSB-LIB-00139705

Third Party Data

Simplo

SIMPLO_TAIWAN_005

EXHIBIT 3

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IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION

CONFIDENTIAL – TO BE FILED UNDER SEAL
SUBJECT TO PROTECTIVE ORDER

IN RE: LITHIUM ION BATTERIES ANTITRUST LITIGATION THIS DOCUMENT RELATES TO: ALL INDIRECT PURCHASER ACTIONS	No. 13-MD-02420 YGR (DMR)

EXPERT REPLY REPORT OF EDWARD E. LEAMER, PH.D.

August 23, 2016

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I. Introduction, Assignment, and Summary of Conclusions

1. I have been asked by counsel for the Plaintiffs in this case to respond to the Expert Report of Ms. Margaret Guerin-Calvert[1] (the "Guerin-Calvert Report").

2. I concluded in my Original Report, dated February 2, 2016,[2] that there is evidence common to members of the proposed Class that can be used to prove widespread impact. That included three kinds of statistical evidence:

   i. Evidence that all cylindrical lithium ion battery ("LIB") prices move together over time;

   ii. Evidence of the amount of overcharge for batteries that the conspiracy caused; and

   iii. Evidence of the extent to which battery prices affect prices of finished products (laptops, power tools and camcorders).

3. I presented evidence of commonality of impact of the alleged conduct by establishing co-movement of all cylindrical LIB prices over time. I also concluded that total overcharges incurred by the Class could be calculated in a formulaic manner. I presented by way of illustration the kind of formulaic overcharge analysis that can be used in this case. I also presented evidence regarding the likely pass-through impact of Defendants' inflated lithium-ion battery prices on prices of their finished products containing those batteries.

4. Ms. Guerin-Calvert has not addressed my work in a meaningful way. In particular, her report dated May 24, 2016 does not address at all the evidence regarding the close co-movements of battery prices, and the consequent spreading of any effect of the price-fixing conspiracy across all or almost all cylindrical LIB batteries.

5. Ms. Guerin-Calvert's comments on my overcharge work are either incorrect, hypothetical or immaterial. Ms. Guerin-Calvert reports that there are "zeroes"

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[1] Expert Report of Margaret E. Guerin-Calvert, May 24, 2016 ("Guerin-Calvert Report").

[2] Corrected Expert Report of Edward E. Leamer, Ph.D., February 2, 2016 ("Leamer Report").

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in my damage estimate but the support she offers for this incorrect idea is only a misquoted and highly misleading snippet extracted from my deposition, and confidence bands that she has wrongly inflated, making the damage estimate seem less certain than in fact it is. Ms. Guerin-Calvert has put forth a list of criticisms of my overcharge analysis, some of which are simply wrong, and for the others she offers no econometric analysis that supports the validity and materiality of the criticisms she makes.

6. Ms. Guerin-Calvert has also offered predictable and mostly irrelevant comments on my pass-through work, but her work on focal point pricing does merit close scrutiny. I explain below that fixed prices associated with focal price points are not very prevalent in real world pricing and can be undone with "free" add-ons to the finished product or by quality competition as a substitute for price competition. The rest of what she has to say about pass-through in this market is either misleading or exaggerated.

7. In addition to addressing the criticisms below, I have added NEC cylindrical LIB to the dataset and made a few minor updates to the data. The results in this Reply Report or in my original Report are not sensitive to these updates. Exhibit A lists additional materials I have relied upon in this Report.

II. Ms. Guerin-Calvert Seems to Deliberately Misunderstand My Testimony

8. Paragraphs 15, 32 and 51 of the Guerin-Calvert Report all wrongly attribute to me in my deposition the phrase "some zeroes and some non-zeroes," as if I had indicated that some members of the class were not harmed. In paragraph 33, she states: "Dr. Leamer admits his regression result is an average and very likely contains customers not impacted because the regression results are "basically an average effect" with "some zeroes and some non-zeroes."

9. In each of these three paragraphs of Ms. Guerin-Calvert's report that repeat the "some zeroes and some non-zeroes" quotation, there is a footnote with the correct quotation: "So you've got some zeros **in your story** and some non-zeros. [emphasis added]" The operative words "in your story" have been confined to a footnote which suppresses a critical point: That's not my story,

that's defense counsel Mr. Kessler's hypothetical that has some zeros and some non-zeros.[3]

10. Mr. Kessler asked me in my deposition: "In other words, am I correct that the way it's specified, your model is not actually detecting whether there's an overcharge in each single cell, but that if it finds it on some, it's going to take those results and apply it across the universe; is that correct?" To this I replied "So you've got some zeros in your story and some non-zeros. If you think of the regression results, it's basically an average effect." Mr. Kessler followed this answer with the question: "There will be, you believe, some zeros to the average?" **"No, I don't."** was my answer. Mr. Kessler tried again to get the answer he wanted: "Well, there could be some zeros in the average?" I tried again to make my opinion clear with the response, **"Well, I prefer to think there's some small numbers and some large numbers, and what we're estimating is an average here."** Mr. Kessler tried again: "Let me do it this way: There's going to be some data in the average for which there's no statistically significant overcharge found at the 90 percent confidence level; correct?" Once more I tried to say the same thing: **"But that is completely different from a zero."**[4] [Emphasis added.]

11. In a passage in paragraph 8, that is rhetorically similar, Ms. Guerin-Calvert reports that "In fact, Dr. Leamer's model produces a very small overcharge of less than a dollar on each cell, a result that Dr. Leamer concedes "could be zero" at times." Again in a footnote to this paragraph, Ms. Guerin-Calvert has the actual quotation from my deposition: "I think the court needs to know that there's uncertainty in the damage estimate. That the best damage estimate embodied in this coefficient is .004. It [c]ould be twice as big, or it could be zero."[5] Nowhere did I use the misleading Guerin-Calvert words "at times."

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[3] Guerin-Calvert Report, 6, 11-12, 21.

[4] Deposition of Edward E. Leaner, Ph.D., April 26, 2016 at 320:8-321:11. ("Leamer Deposition")

[5] Guerin-Calvert Report, 3; Deposition of Edward E. Leaner, Ph.D., April 26, 2016 at 136:16-20.

12. My statement applies to any statistical estimate of damages, provided that the standard error of the estimate is not zero. I did not say that 0.004 and 0.000 were equally likely. What I said, in effect, is that when 0.004 is the estimate, twice that number, 0.008, and zero are equally likely. ("It could be twice as big or it could be zero.") Thus twice the damages is just as likely as zero, no matter what is the standard error of the damage estimate.

13. In terms of likelihood, a z-statistic of 1.698 (like the t-stat applicable to the conspiracy coefficient 0.0042) means that 0.0042 is 4.23 times as likely as zero. That seems a large enough preference for 0.0042 compared with 0.000 to infer positive damages. At issue, really, is how accurate must a damage estimate be for a court wisely to award damages, something I discuss in the next section.

14. In sum, my statements were taken out of context and used in a way that does not represent my opinions at all, and that seems to obscure or ignore some very basic principles of statistics.

15. This pattern is repeated elsewhere as well. For instance, much ink is spilled on the idea that the regression calculates a single conspiracy coefficient for the entire period and this somehow reflects poor application of statistical techniques.[6] My response to that is: that is how regression analysis works, as Ms. Guerin-Calvert surely knows. Another approach would be to run separate regressions on a yearly or monthly basis—but this would directly and dramatically reduce the explanatory power of the regression, possibly to the point of making it non-functional. I note that even Ms. Guerin-Calvert does not advocate this approach, which she surely knows is wrong.

[6] Guerin-Calvert Report, 3, 5, 10, 12, 21, 26, 44, 50, 54.

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III. Overcharges

A. Ms. Guerin-Calvert's Figure 1 Illustrating Overcharge Confidence Intervals Is Wrong and the Message of This Image Is Quite Different When the Errors Are Corrected

16. Ms. Guerin-Calvert leads off her report with her Figure 1 (reproduced below) from which she draws the conclusion in paragraph 10: "The results of Dr. Leamer's overcharge model demonstrate its invalidity for the class-wide purpose offered. One can readily see that almost all of Dr. Leamer's dollar overcharges (damages) come from one time period beginning around April 2007."[7] With these words, Ms. Guerin-Calvert is simply describing the fact that her confidence intervals for the but-for prices include the actual prices except during the period of elevated cobalt-price sensitivity.

17. While I dispute below the applicability of the conventional confidence levels that Ms. Guerin-Calvert has chosen to create for her display, there is something else important here: something is obviously wrong with her Figure 1 (and Exhibit 2) because it purports to show a much higher degree of uncertainty than the actual regression results, which do meet her chosen significance levels of 95% or 90%. The explanation for this puzzling difference is in the fine print: she has opted for "bootstrapping,"[8] which is a way of computing confidence intervals which suffers from special complexities when dealing with times series data sets and models like mine that have intertemporal dependence. Her bootstrap method has been wrongly applied, which has greatly increased the length of the confidence intervals. Rather than getting into the details of the code that she has used, it is enough to establish some basic features that these confidence intervals should have, and show that the intervals that Ms. Guerin-Calvert has produced are clearly overly wide. As I show below, using an appropriate and standard method to generate the same

[7] Guerin-Calvert Report, 4.

[8] Bootstrapping methods draw multiple sets of random samples (with replacement) from a data set and then conduct tests or construct statistical measures such as confidence intervals using the samples.

chart—the Monte Carlo method[9]—results in a chart completely in tune with estimates and standard errors that come with the regression equation. Moreover, Ms. Guerin-Calvert's critical comment quoted in the paragraph above relies on the fact that a large fraction of her 95% confidence intervals overlap with the actual prices, which is also true of 90% intervals calculated with her procedure, but none of the correctly calculated 90% intervals overlap the actuals. The technical reasons for this now follow.

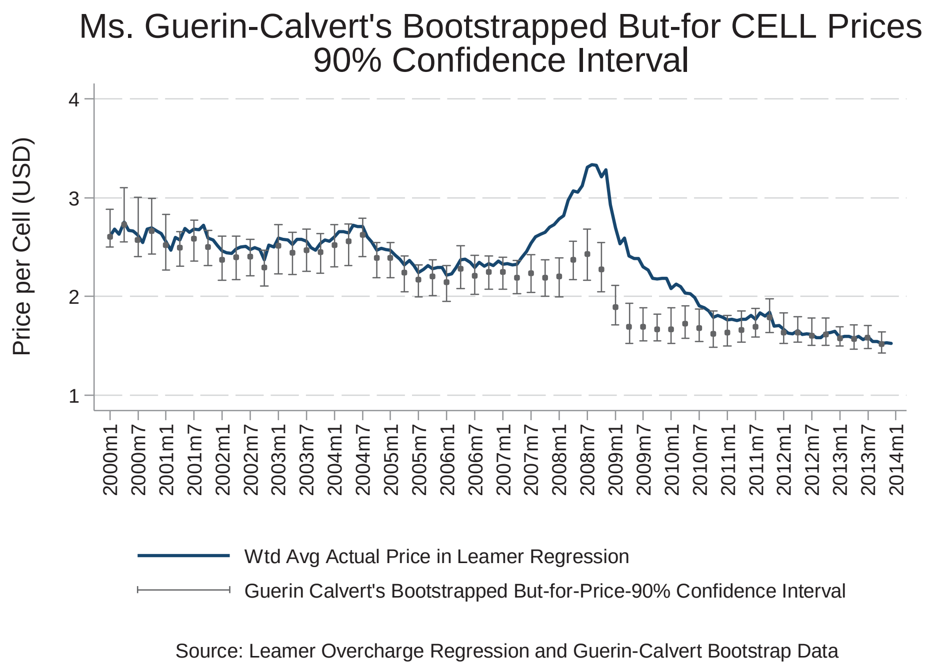
18. My model has a form such that the confidence intervals when the conspiracy is just beginning should be relatively short and the intervals should grow over time in those early years and then stay a constant width until the cobalt sensitivity period. Furthermore, the error bands near the end of the period of observation, when the effect of the conspiracy has almost completely disappeared, should be very short. In addition, the initial 90% confidence intervals for the but-for prices should not include the actual price since the conspiracy coefficient is significant at the 90% level. Beyond the initial period, the coefficient of the lagged price also affects these confidence intervals but this coefficient is estimated with enough accuracy that it will not have much effect on the percentage error. Parenthetically, if we were testing the one-sided hypothesis that prices would have been lower in the but-for world against the hypothesis of no effect, a statistically significant conspiracy coefficient using a confidence level of 90% implies a 95% confidence for a one-sided confidence interval. This is the level or better that is achieved for each and every one of the months in the data set.

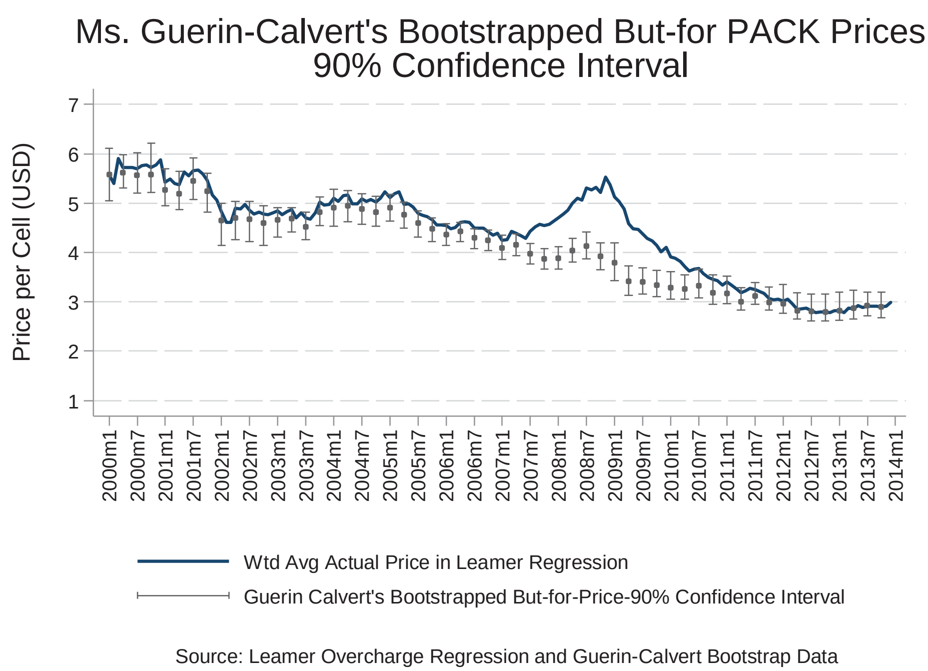
19. Figure 1 below shows 90% confidence intervals for cells and cells in packs formed with Ms. Guerin-Calvert's bootstrap method, the choice of 90% foreshadowing the discussion to come later: there is nothing sacred about either 95% or 90%. Below these in Figure 2 are the correct intervals. Her intervals are overly wide, thus wrongly lending support to her inappropriate

[9] Monte Carlo methods use repeated sampling from one or more distributions to solve computational problems involving random variables. Here the random variables are the coefficients of the overcharges regression, of which the overcharges confidence intervals are a function.

advice that the overcharge estimate for cells is too uncertain to rely on. Her intervals are especially overly wide at the beginning and the end of the period included in this figure. These features are inconsistent with the regression model that I have estimated and the presence of these features demonstrates the incorrectness of Ms. Guerin-Calvert's inappropriately wide intervals. Incidentally, because of the bars used to display the end points of these intervals, some of the correct 90% intervals may appear to overlap the actual prices, but in fact none of them do.

Figure 1 – Incorrect But-for Price 90% Confidence Intervals





20. I now will explicitly link the coefficients in my overcharge regression with the estimated overcharge. The model that I and Ms. Guerin-Calvert have used to describe the cell price before the period of elevated cobalt sensitivity takes the form

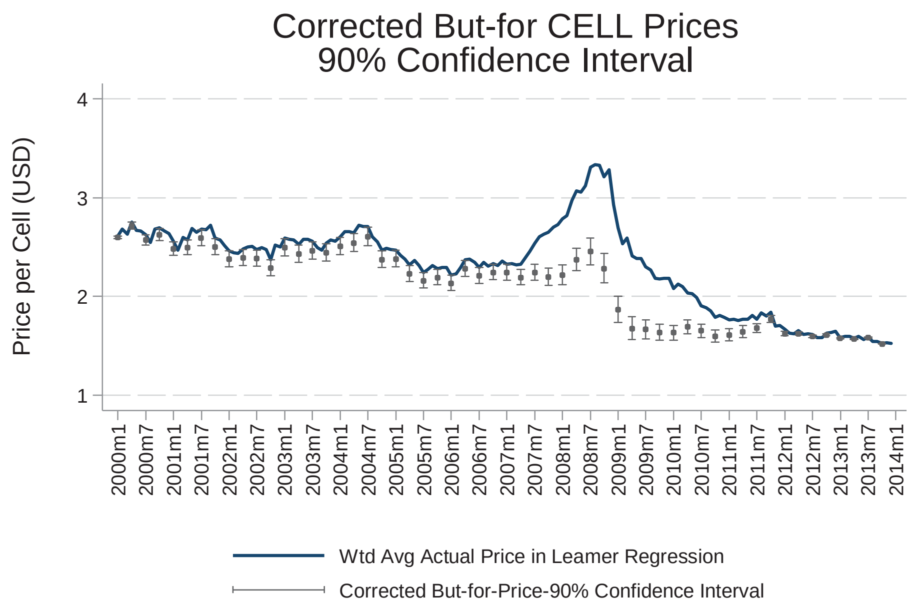
$$\log(p_t) = \alpha + \beta \log(p_{t-1}) + \gamma x_t + \delta Z_t + \varepsilon_t$$

where p_t is the cell price in period t, x_t refers to various included drivers, Z_t is a binary indicator taking on the value one when the conspiracy was operating and zero otherwise, δ, β, γ and δ are uncertain parameters and ε_t is the "residual" that captures various small effects left out of the model.

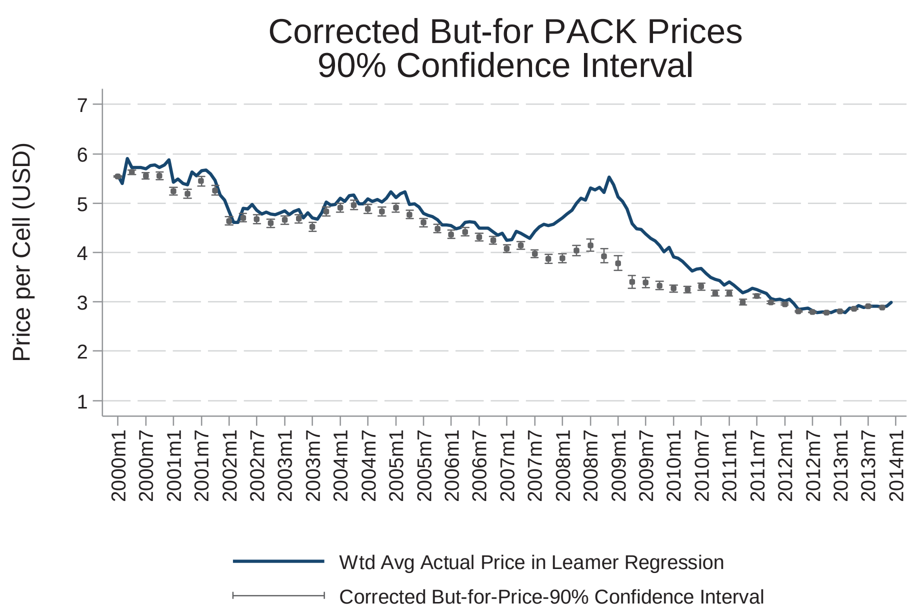
21. The overcharges in this kind of model can be found by setting Z to the but-for value of zero and contrasting that result with the model's prediction when Z takes on its actual value: equal to one. The initial overcharge percentage is just the coefficient on Z: δ. The second period overcharge is larger – it includes a direct effect equal to δ plus a lagged effect from having removed the conspiracy in the first period. This second period overcharge is $\delta(1+\beta)$. The ongoing sequence of overcharges takes the form: δ, $(1+\beta)$, $\delta(1+\beta+\beta^2)$, $\delta(1+\beta+\beta^2+\beta^3)$ … converging to the "long-run" effect equal to $\delta/(1-\beta)$.

22. If, in the last period in which the conspiracy operated, the overcharge was at the long-run level of $\delta/(1-\beta)$ then in the first after-period the effect is reduced to $\beta\ \delta/(1-\beta)$ and then in the next period to $\beta^2\ \delta/(1-\beta)$ and so on to $\beta^T\ \delta/(1-\beta)$ where T measures the number of months since the conspiracy was in operation. This will grow smaller and smaller if β is less than one.

Figure 2 – Correct But-for Price 90% Confidence Intervals



Source: Leamer Overcharge Regression and Monte Carlo Sampling



Source: Leamer Overcharge Regression and Monte Carlo Sampling

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23. In the cell equation reported in my Figure 34 of the earlier Report, the estimated value of δ is 0.0042 with a standard error of 0.0025, which in percentage terms is 58.9%. Thus the effect of the conspiracy in the first period δ is estimated to raise battery prices by 0.42% with a standard error of 0.25%. A one-standard error confidence interval for δ is $\pm 58.9\%$ and does not include zero, while a two-standard error interval is $\pm 117.9\%$ which does include zero. The estimated value of β is .8927 with a standard error of 0.00593, which in percentage terms is only 0.66%. This coefficient is estimated so accurately that it hardly contributes to the inaccuracy of overcharges like the formula $(1 + \beta + \beta^2 + \beta^3)$. Thus what we should be seeing in the figures above at the beginning of the display is a damage estimate that starts at δ = 0.0042 = 0.42% and slowly rises toward the long-run effect $\delta/(1 - \beta)$= 3.9% and a confidence interval that rises proportionately, maintaining approximately a $\pm 58.9\%$ width. The correct intervals (see Figure 2, above) have this feature, whereas Ms. Guerin-Calvert's are incorrectly wide, noticeably so at the beginning of the period.

24. In addition, from the end of the conspiracy in April 2011 to the end of the data set in December 2013 there are 32 months. With T=32, β^T is only 0.0265, which means that only 2.7% of the overcharge remains. Thus the (approximate) estimated overcharge in December 2013 is $\beta^T\ \delta/(1 - \beta)$=0.1% with a standard error that is approximately 59% of that very small number. That produces intervals that are hardly perceptible, as in my correct figure.

25. What's gone wrong here: bootstrapping run amuck. I have not used the bootstrapping technique but instead have used a Monte Carlo approach which accounts for the uncertainty in the coefficients by drawing repeated values of estimates of the coefficients out of a suitably defined probability distribution thus allowing me to find statistical properties of the nonlinear functions of the coefficients like , $\delta(1 + \beta + \beta^2 + \beta^3)$. This Monte Carlo approach is much simpler in operation than bootstrapping (repeated re-sampling from the actual data set) and thus less susceptible to error, but whatever is the technique for characterizing the uncertainty, the results need to be subjected to a sniff test to make sure nothing has gone wrong. Ms. Guerin-Calvert's confidence intervals don't pass that test and are wrong under careful examination.

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26. Lastly, I very strongly object to the wholesale adoption of conventional significance levels like the 95% confidence intervals used in Ms. Guerin-Calvert's Report, a subject to which I now turn.

B. The Reliability of a Damage Estimate Is Not Wisely Determined by Mechanical Application of Statistical Significance Levels, as Suggested by Ms. Guerin-Calvert

27. Ms. Guerin-Calvert complains in Section C that "Dr. Leamer Does Not Follow Conventional Practices for Hypothesis Testing and Statistical Significance."[10] By "conventional practices," she is referring to selecting a conventional level of accuracy of a damage estimate at which an expert should recommend that no damage award should be made. Her comment is not about completeness of reporting; it is only about interpretation of the results. A damage award should be partly determined by the data evidence but also should depend on documents and testimony that either support or cast doubt on the hypothesis that damages occurred. If this other evidence very strongly favors the existence of some level of damages, then the function of the data analysis is mostly to estimate the level of damages and not to test if damages occurred. In the extreme case with documents that prove the existence of damages but do not reveal the level, then damages should equal the most accurate unbiased data estimate of damages, regardless of the statistical precision of that estimate, unless evidentiary standards push the award either up or down. On the other hand, if the non-statistical evidence provides little support for awarding damages, then the data may play a dual role of testing if there were damages and also estimating the level. In that case, there is a level of inaccuracy of the damage estimate at which no award should be made.

28. Rather than usurping the Court's role of wisely weighing all the evidence, I have taken my primary task to be to report a summary of the data evidence in the form of the best estimate of damages together with a numerical description of the uncertainty in that estimate. I am ready to offer the Court more advice on how to combine this evidence with the documentary evidence if asked.

---

[10] Guerin-Calvert Report, 23.

29. Aside from the common-sense notion that a damage award should be based on all the evidence, not just the numerical record, Ms. Guerin-Calvert's advice does not take into consideration the fact that her suggested approach is under attack in the academic literature, because it wrongly diverts attention away from issues pertaining to the size of (not the significance of) the coefficients, because it can be easily manipulated, an activity called p-fishing or p-hacking in the academic literature, referring to the search for models or data that meet Ms. Guerin-Calvert's conventional standards for p-values. Ironically, her approach in this litigation context (for instance, her misuse of "bootstrapping") appears to be to search for models or approaches that do *not* meet these conventional standards. Either way, her approach to p-values is inappropriate.

30. Technically, a statistician uses the data to create an estimate of some unknown quantity like the level of damages, and attaches to that estimate a corresponding standard error which is the basis for computing a confidence interval with a selected probability of including the true value in repeated samples from the same population. The conventional probabilities for confidence intervals are 0.90, 0.95, and 0.99, corresponding to successively wider intervals. If the confidence interval with the 0.95 level of capturing the true value does not include zero, it is said that the estimate is "statistically significant at the 5% level," meaning statistically bounded away from zero in a precise mathematical sense. It is also conventional to report a p-value, or just-significance level. A p-value equal to .04, for example, means statistical significance at the 0.05 level but not the 0.01 level.

31. The academic literature has much criticism of Ms. Guerin-Calvert's advice. Sir Ronald Fisher, who developed hypothesis testing, was an early critic:

> However, the calculation [at the 1% level] is absurdly academic, for in fact no scientific worker has a fixed level of significance at which from year to year, and in all circumstances, he rejects hypotheses; he rather gives his mind to each particular case in the light of his evidence and his ideas. It should not be forgotten that the cases chosen for applying a test are manifestly a highly selected set, and that the conditions of selection cannot be

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> specified even for a single worker; nor that in the argument used it would clearly be illegitimate for one to choose the actual level of significance indicated by a particular trial as though it were his lifelong habit to use just this level.[11]

32. More recently, Stephen Ziliak and Deirdre McCloskey[12] have written the provocatively titled book: "The Cult of Statistical Significance: How the Standard Error Costs us Jobs, Justice, and Lives." One academic journal has actually banned significance testing in 2015:

> "The Basic and Applied Social Psychology (BASP) 2014 Editorial emphasized that the null hypothesis significance testing procedure (NHSTP) is invalid, and thus authors would be not required to perform it (Trafimow, 2014). However, to allow authors a grace period, the Editorial stopped short of actually banning the NHSTP. The purpose of the present Editorial is to announce that the grace period is over. From now on, BASP is banning the NHSTP."[13]

33. The Journal of the American Statistical Association, one of the premier statistical journals, issued the following commentary on statistical significance and p-values on March 7, 2016:[14]

> "The p-value was never intended to be a substitute for scientific reasoning," said Ron Wasserstein, the ASA's executive director. "Well-reasoned statistical arguments contain much more than the value of a single number

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[11] Ronald A. Fisher, *Statistical Methods and Scientific Inference 3rd ed.*, (Macmillan Pub Co., 1973), 44-45.

[12] Stephen T. Ziliak and Deirdre N. McCloskey, *The Cult of Statistical Significance: How the Standard Error Costs us Jobs, Justice, and Lives*, (University of Michigan Press, 2008), 2302-2316.

[13] David Trafimow, and Michael Marks, "Editorial," *Basic and Applied Social Psychology*, 37(2015): 1.

[14] "American Statistical Association Releases Statement on Statistical Significance and P-Values," American Statistical Association News, March 7, 2016.

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> and whether that number exceeds an arbitrary threshold. The ASA statement is intended to steer research into a 'post p<0.05 era.'"
>
> …
>
> The statement's six principles, many of which address misconceptions and misuse of the p-value, are the following:
>
> 1. P-values can indicate how incompatible the data are with a specified statistical model.
>
> 2. P-values do not measure the probability that the studied hypothesis is true, or the probability that the data were produced by random chance alone.
>
> 3. Scientific conclusions and business or policy decisions should not be based only on whether a p-value passes a specific threshold.
>
> 4. Proper inference requires full reporting and transparency.
>
> 5. A p-value, or statistical significance, does not measure the size of an effect or the importance of a result.
>
> 6. By itself, a p-value does not provide a good measure of evidence regarding a model or hypothesis.

34. In addition, it is important to understand that these conventional significance levels can be met by keeping the number of model parameters to be estimated small compared with the number of observations, and they can be "defeated" by breaking up the data into smaller and smaller pieces relative to the number of parameters. The defendants thus have a rhetorical incentive to "disaggregate" meaning estimating different models with different subsets of the data, distinguished by time period or by product type or by some other

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variable, thus producing high p-values because the relevant sample sizes have been reduced. The Court may notice that this is the approach taken in every single one of Ms. Guerin-Calvert's analyses: to reduce the number of observations and then emphasize the increased p-values (or the wildness of the results—which again results from trying to estimate the regression from inadequate data). But this works two ways. Actually, there is a very good reason to aggregate my work, combining the cell and the pack data into one regression, which produces even lower p-values.

35. The damage models reported in my Figure 34 in my original report are estimated separately with the cylindrical cell data and with the cylindrical pack data. The estimated overcharge coefficients that apply to the full conspiracy period are virtually identical for the cell 0.004 (0.4%) and the pack regression 0.005 (0.5%) but the standard error of the conspiracy effect in the cell regression is greater than the corresponding standard error of the pack equation. As a consequence, although the pack conspiracy coefficient is statistically significant at the 1% level (three asterisks) the cell conspiracy coefficient is statistically significant at the 10% level (one asterisk) but not the 5% level or the 1% level. Without explaining why, Ms. Guerin-Calvert transforms the estimated 0.4% impact of the conspiracy into a zero: Paragraph 10: "One can readily see that almost all of Dr. Leamer's dollar overcharges(damages) come from one time period beginning around April 2007."[15] Paragraph 14: "there are subsets of customers within the data across all periods that I show, using Dr. Leamer's methodology, have no measureable impact due to the alleged conspiracy."[16] Paragraph 16: "Dr. Leamer conceded in his deposition that the overcharge regression results are 'basically an average effect' with 'some zeroes and some non-zeroes.' Dr. Leamer thus acknowledged that his model cannot differentiate between specific situations where there is an overcharge and where there is no overcharge."[17] There is no

[15] Guerin-Calvert Report, 4.

[16] Guerin-Calvert Report, 5.

[17] Guerin-Calvert Report, 6.

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similar discussion of the pack equation, because it has a statistically significant effect for the coefficient in question at the "magical" 1% level.

36. Most of the difference in statistical significance between the cell and the pack regression comes from the fact that the cell regression has 5,440 observations while the pack regression has 17,647, about three times as large. This is an excellent illustration of what slavish dependence on conventional levels of p-values amounts to: it's only measuring the sample size relative to the number of estimated coefficients. If the sample size is small, coefficients have a difficult time achieving statistical significance but if the sample size is large enough, almost everything is statistically significant.

37. The reason I "disaggregated" and estimated the cell and pack regressions separately was because packs use cells as inputs but packs also include other inputs and additional processing. The packing margin over the cell costs could vary over time, and could be affected by the conspiracy in a different way. But it has turned out that the regression equations for cells and for packs in my Figure 34 are very similar, which suggests pooling them into one. Exhibit 1 reports the outcome. Here everything is statistically significant. In the separate regressions the coefficients of the conspiracy indicator (Jan 2000 to April 2001) are 0.0042 for cells and 0.0050 for packs, the corresponding t-stats are 1.70 and 3.52 and p-values are 0.0895 and 0.0004 , but in the pooled regression below the combined estimate is 0.0044, the t-value is 3.57 and the p-value is 0.00036.

38. Another reason to aggregate the cell and pack data is that the conspirators themselves viewed the market this way. They talked about increasing cell and pack prices at the same time and by the same "per cell" amounts.[18]

39. I am not offering this as a new or substitute regression but rather as an illustration of just how easy it is to forget the purpose of the analysis in

[18] See e.g., Deposition of Kazuhiro Nakae at 24:21-23, 42:17-43:2, 200:24-201:9, 210:12-214:4, 228:17-25; Deposition of Kazuhiro Nakae Exhibit 2078E PANA-C000173982E (planned discussion between Panasonic and Sanyo about "price hike of cobalt," including "discuss[ing] the policies especially for [pack customers] Toshiba, ACER, ASUS, ODM . . ."); Deposition of Kazuhiro Nakae Exhibit 2070E, PANA-C000073662E ("Driven by the price adjustments of batt[er]y cell suppliers, large Taiwanese battery manufacturers have recently officially increased their product sales prices.").

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focusing too much on statistical significance. The purpose of the analysis is to understand just what the data can tell us about the effect of an alleged conspiracy over the time period of January of 2000 into early 2011. It turns out that whether viewed separately or together, the sales data for cells and packs can tell us quite a lot and with a good deal of certainty about how effective this conspiracy was given these market conditions. Ms. Guerin-Calvert does not propose a *better* or *alternative* way to achieve this goal; as discussed in more detail below, she simply breaks apart the data with the apparent purpose of producing wild and statistically uncertain results.

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C. Ms. Guerin-Calvert Misunderstands My Pack Overcharge Model Which Uses a Price Per Cell Dependent Variable and Apparently Failed to Read Dr. Noll's Complete Comment on This Issue.

40. I will now address Ms. Guerin-Calvert's claim that my pack regression is "nonsense" and her attempt to create a contradiction between my views and Dr. Noll's.[19] In reality, Dr. Noll and I view this matter very similarly and Ms. Guerin-Calvert's "nonsense" comment depends on a false and incomplete reading of his testimony.

41. A cylindrical battery pack includes one or more cylindrical cells encased in a housing together with electronics that control the collective operation of cells including safety. The pack price per cell of battery packs exceeds the price per standalone cell because there is a "packing margin" reflecting the costs of the packing and also reflecting the different competitive marketplaces that packs may experience compared with standalone cells. The potentially different marketplaces for cells and packs allows a potentially different effect of the conspiracy on prices of packs than on prices of standalone cells, something I have explored econometrically.

42. There are a variety of models that might link the price of the pack to the number of cells in the pack. It could be that there is a fixed packing cost independent of the number of cells and thus the cost of pack production is additive; the cost of the cells plus the fixed cost of the packing. It could be that each additional cell adds the same amount to the packing costs, which makes the total cost of the pack (cell plus packing costs) proportional to the number of cells. It could be a combination of a fixed charge for packing plus a cost that is proportional to the number of cells. Or it could be that the packing costs depend on the cell array, with a 2 by 3 array of six cells having one level of packing cost and a 1 by 6 array having a different level of costs. Or something else.

[19] Guerin-Calvert Report, 7.

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43. In order to deal with this complex stew of possibilities I have estimated a model for the pricing of packs which uses the dependent variable equal to the logarithm of the pack price divided by the number of cells. If not offset by other features of the model, this would impose the assumption that the packing costs and packing markup are proportional to the number of cells in the pack. One possibility, adopted by Dr. Noll, is to include in the pricing model the number of cells as a right-hand side variable.[20] This allows for a constant percentage increase in pack price for each percentage increase in number of cells, but not necessarily one for one. My model has "fixed effects" which are binary indicators for each and every value of the number of cells. This allows the data complete freedom to determine the effect of number of cells on the pack price. Ms. Guerin-Calvert has not taken notice of these fixed effects, or she does not understand how they operate.

44. Under the heading "Dr. Leamer's Methodology Improperly Attributes Price Increases on Components of Battery Packs Other Than Cells to the Claimed Conspiracy," Ms. Guerin-Calvert has written:

> 19. In this analysis, Dr. Leamer improperly calculates the price of cells in packs. Instead of investigating actual cell costs, he simply divides the total pack cost by the number of cells, and thus attributes the cost of all other pack components to cells. This calculation renders the analysis unreliable as it erroneously inflates the cell prices to which Dr. Leamer's average overcharge rates are applied to include the costs of other pack components. In fact, Direct Purchaser Plaintiffs' economist, Dr. Noll,

[20] Declaration on Class Certification of Roger G. Noll, January 22, 2016, 75 ("Noll Declaration"); Deposition of Roger G. Noll. Ph.D., May 6, 2016 at 118:4-119:16. A "right-hand side" variable is an explanatory variable in a regression model, i.e., it is a factor which is believed to influence the left-hand side variable, also called the dependant variable.

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> referred to this cell price calculation for packs/cells as "nonsense."[21]

45. This paragraph of Ms. Guerin-Calvert is quite wrong. First of all, she takes Dr. Noll's "nonsense" comment out of context which allows a 180 degree misinterpretation of what he actually said. The same response in the deposition testimony of Dr. Noll that she uses to suggest my work is "nonsense" includes a sentence that describes the corrective action that is embodied in my fixed effects. Ms. Guerin-Calvert does not quote this sentence, misrepresenting Dr. Noll's testimony and ignoring the key words by Dr. Noll (below in bold):

> "The original regression estimated pack prices as the price per cell, and I didn't – I decided I didn't like that because it was nonsense, basically. So, you know, it was not the right way to take into account -- there was no reason to believe that there was a linear relationship between the number of cells and the price of a pack. So I wanted the regression to tell me whether that was true. **So that's when we put the number of cells in as a right-side variable. It turns out it doesn't really matter. You get the same answer**."[22]

46. I have put in bold Dr. Noll's suggested correction for the "nonsense" (He suggests including the number of cells in the equation that uses price per cell as the dependent variable). I have also put in bold Dr. Noll's finding: It turns out it doesn't really matter. In other words, there was not mistake in the way I analyzed pack overcharge. And this doesn't really matter.

47. Ms. Guerin-Calvert should have but did not take a close look at my regression equation in Figure 34 in my original report to determine whether I included number of cells as a right-hand side variable. Alternatively, she might have re-

[21] Guerin-Calvert Report, 7.

[22] Deposition of Roger G. Noll. Ph.D., May 6, 2016 at 132:4-14.

estimated my equation with the log of the number of cells included. Either approach should have led her to footnote one in Figure 34 which indicates that my model includes fixed effects for number of cells. These fixed effects distinguish each level taken on by the number of cells (except that observations for which the number of cells exceeds 30 were omitted because these batteries are used in electric bikes). Thus I carry Dr. Noll's advice one step further, allowing not just a log linear relationship between pack price and number of cells but a free-floating unrestricted relationship between price of the pack and number of cells in the pack.

48. Rather than just relying on Dr. Noll's advice, we can work this out ourselves. When we do, we discover that the alternative model that Ms. Guerin-Calvert seems to approve and the one that I have used produce exactly the same results. Suppose one conformed with Ms. Guerin-Calvert's apparent advice by using a log-linear model explaining the logarithm of the pack price as a function of a binary conspiracy variable indicating the time period during which the conspiracy was operative and also the log of the number of cells, allowing for the fact that the packs with more cells are probably more expensive. Thus, the model with fixed effects is:

$$\log(Pack\ Price) = \alpha + \beta Log\big(Pack\ Price(-1)\big) + \gamma Log(Num\ Cells) + \delta Conspiracy + Fixed\ Effects$$

where *Conspiracy* is a binary indicator of the period over which the conspiracy was operating and δ is initial percentage impact of the conspiracy on pack prices. I assume that Ms. Guerin-Calvert would accept this form of the equation since she has not complained about the same equation for cells.

49. A mathematically identical model can be found by subtracting the log(Num Cells) from both sides of the equation. This alternative model then has the log of the pack price divided by the number of cells as the dependent variable, with the right-hand side suitably adjusted:

$$\log\left(\frac{Pack\ Price}{Num\ Cells}\right) = \alpha + \beta Log\left(\frac{Pack\ Price(-1)}{Num\ Cells(-1)}\right) + (\gamma - 1 + \beta)Log(Num\ Cells) + \delta Conspiracy + Fixed\ Effects$$

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where I have used the fact that Num Cells (-1) = Num Cells. Finally, if the fixed effects are capable of perfectly predicting the log of the number of cells, then we are forced to omit the Number of Cells and have all of its influence absorbed by the fixed effects.

50. These two models are mathematically identical and will produce exactly the same estimates of all the coefficients including the conspiracy indicator. The parameter δ is either the initial percentage impact of the conspiracy on the pack price or the initial percentage impact of the conspiracy on the pack price per cell. These are exactly the same number (confirmed in the regression equation in Exhibit 2 which uses pack prices as the dependent variable). This renders meaningless Ms. Guerin-Calvert's words "This calculation renders the analysis unreliable as it erroneously inflates the cell prices to which Dr. Leamer's average overcharge rates are applied to include the costs of other pack components."[23] My overcharge rates on packs are completely correct and are correctly applied to the per-cell prices of packs to calculate but-for prices.

51. Furthermore, this is consistent with communications among Defendants that might at times refer to percent increases in cells in packs or equivalents in percent increases in packs.[24]

D. Ms. Guerin-Calvert's Disaggregation by Customer Group Has Predictable Effects: Wild Estimates, Larger Standard Errors, Higher P-Values

52. A prime example of Ms. Guerin-Calvert's approach to turning good results into wild and uncertain ones can be found in her "power tool" and "camcorder" regressions. Specifically, she has estimated my overcharge model using only those cells and packs that were shipped to selected subsets of customers: OEMs that produce only power tools (Guerin-Calvert Report Exhibit 31) and OEMS that produce only Camcorder and Cameras(Guerin-Calvert Report

[23]Guerin-Calvert Report, 7.

[24] See e.g., SDI-B-000005322E – 5323E ("Please understand said % is per cell and not per pack"; explanation that cell increase is 8~10% and pack increase is 4~5%).

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Exhibit 32). She doesn't stop just with customer group disaggregation – she feels it appropriate to exclude cells of dimension 26650 from the Power Tool category. This reduces the number of observations for the power tool cell equation from 5,440 to 417 and for the power tool pack equation from 17,647 to 906. It reduces the number of observations for the camera pack equation to 1,794. Because of this massive reduction in sample size, one should be wary about putting much reliance on p-values or significance levels.

53. A word should be said here about the decision to include cylindrical LIB cells meant for use in power tools and camcorders in the same regression as other cells. A possible reason to break them out would be the need to include an explanatory variable with particular relevance to price movements of those kinds of cells and not to others. I am aware of no such variable and I see none that has been brought up by Ms. Guerin-Calvert. On the other hand, my opening report details hundreds of regressions I used to confirm what economic theory predicts, namely that forces of substitution will act as a glue holding together prices of different cells, including those for power tools and camcorders. This is a good reason to conclude that these data are properly analyzed together.

54. Of course, Ms. Guerin-Calvert does not undertake her own work to show, empirically, why these battery cells should be treated differently; she simply does it and then points to the result. I have explained above why excessive disaggregation favors defendants. Disaggregation spreads the limited data resource over more parameters to be estimated or reduces the number of observations while holding fixed the number of parameters, thus causing wilder estimates with larger standard errors, smaller t-values and larger p-values. Ms. Guerin-Calvert's Exhibits 31 and 32 report results that conform to this prediction with one important exception: the coefficient on the conspiracy indicator for the Camcorder/Camera data set is negative and statistically significant. This coefficient implies that the impact of the conspiracy was an initial reduction in pack prices by 3.58%, and a long-run reduction of 11.8%. I don't think anyone thinks that the conspiracy lowered battery prices relative to but-for prices. So something has gone wrong here. It's either a data problem

or a model problem or both. There are some very serious problems with the data set used by Ms. Guerin-Calvert that are discussed next.

55. Specifically, Ms. Guerin-Calvert has studied a data subset composed of shipments to selected OEMs. Conclusions that may come from these data need to have a warning label because the defendants' transactional data sets do not generally include the product for which the cell or pack is destined and sometimes do not include the customer to which the product was shipped. The top panel in Figure 3 below illustrates the industry wide shares of cylindrical cells used in camcorders/cameras, power tools, and other applications, compiled by IIT. The bottom panel Figure 3 illustrates the corresponding Guerin-Calvert data. Here we see that the data she is using comprise a small fraction of the actual sales of cells for use in power tools, cameras and camcorders.

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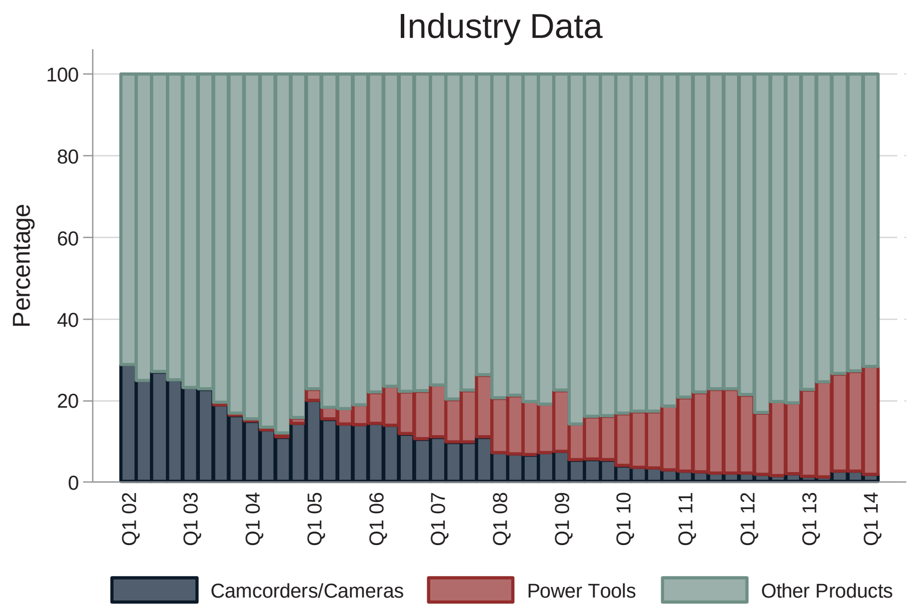
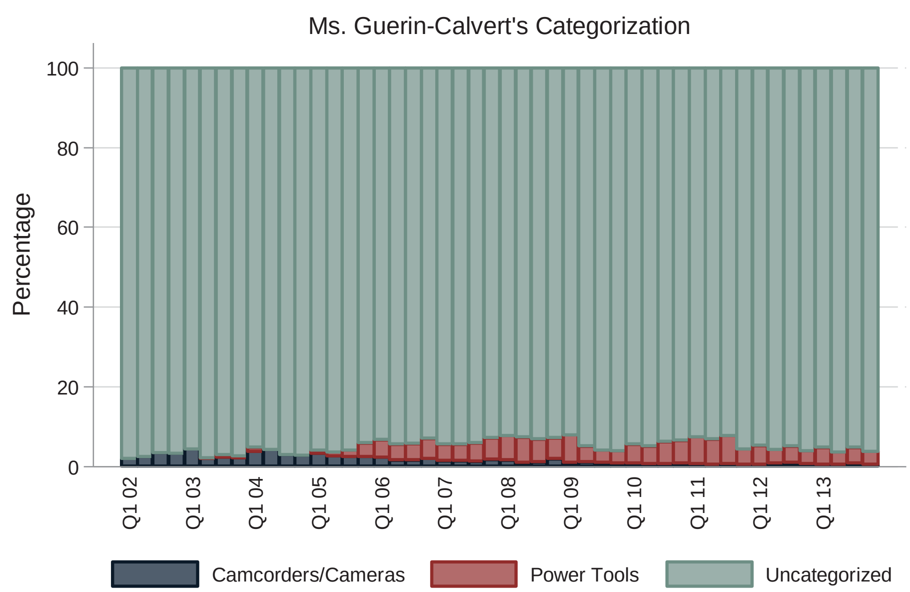
Figure 3 – Share of Cylindrical Cell Sales by User Type



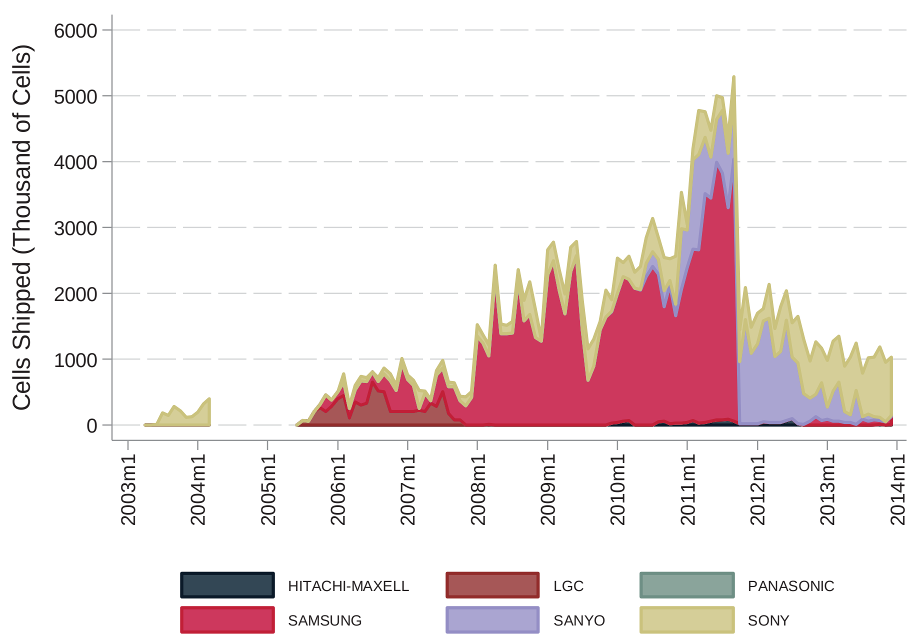
Sources: IIT Data, LIMX2004.XLS, LIMX2011.xls, and Limtrx2014.xls



Source: Ms. Guerin-Calvert's Backup
Note: Restricted to years in which industry data was available.

56. But this is not the only problem--there is also the issue of how her slicing of the data eliminates the "before" data necessary to construct a "before and after" model. Figure 4 below illustrates the shipments of cells over time from defendants to (exclusively) power tool manufacturers as identified by Ms. Guerin-Calvert. It's not just a non-representative subset of data. This data set is problematic because it has no "before" data, because data are not present from April 2004 to May 2005 in the midst of the first run-up of cobalt prices, and because the Samsung-Bosch data dominate until November 2011, shortly after the end of the class period, at which point the data simply end. The absence of early data makes it more difficult to carry out a before and after comparison with the conspiracy period. The missing data in the middle make it difficult to estimate a two different cobalt sensitivity coefficients, and the Samsung-Bosch influence is something that should be explored.

Figure 4 – Shipments of Cells to Power Tools Manufacturers (As identified by Ms. Guerin-Calvert)

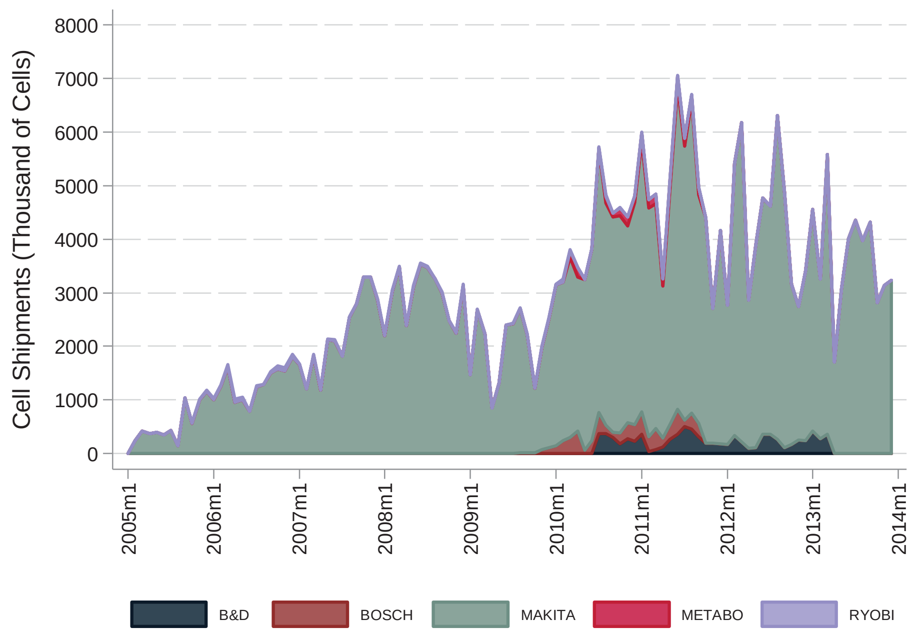


Source: Ms. Guerin-Calvert's Backup

57. The same concern applies to the pack data. Figure 5 below illustrates the shipments of cells in packs to (exclusively) power tool manufacturers over

time. These data begin in January 2005. Thus there is no data before the class period, but in addition the period of the first run-up in cobalt prices in 2004 is also excluded, which makes it very difficult to estimate a separate cobalt price sensitivity during the run-up in cobalt prices in 2007. Shipments of packs to camera OEMs are illustrated in the Figure 6 below. Prior to 2001, hardly any sales were occurring, and this has a potentially contaminating effect on the "before" period, similar to power tools.

Figure 5 – Purchases of Cells in Packs by Power Tools Manufacturers (As identified by Ms. Guerin-Calvert)



Source: Ms. Guerin-Calvert's Backup

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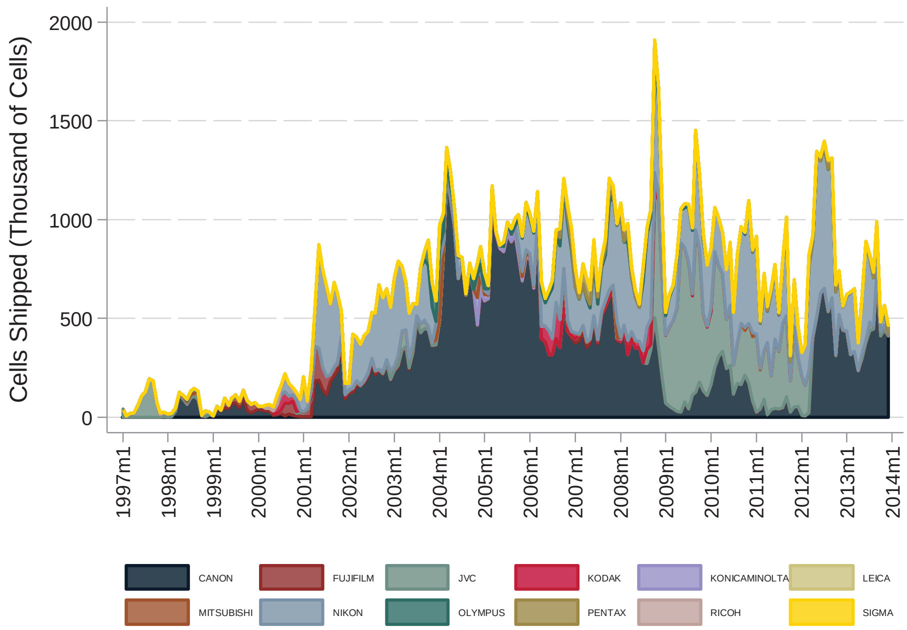
Figure 6 – Cylindrical Pack Purchases by (Exclusively) Camera Makers



Source: Ms. Guerin-Calvert's Backup

58. The limitations inherent in her data set make it a foregone conclusion that slapping on top of it a regression designed to work on a much more complete data set will lead to wild results such as those she has produced. If one wanted to estimate damages for power tools and camcorders separately, one would have to undertake a very different exercise—but one that would still be very difficult in light of this data set. But as I have said before there is no need to do this: I have seen no evidence that the effectiveness of this conspiracy depended on the end use of the LIB cell, as opposed to the general structural characteristics of the LIB market. And the co-movement regressions I performed in my first report, which include co-movements across customers like these, confirm this. Given that it is fair and supportable to assume similarity among these different transactions in estimating the effect of the conspiracy, the econometrically appropriate thing is to include all of them in order to achieve the maximum possible power, as I have done.

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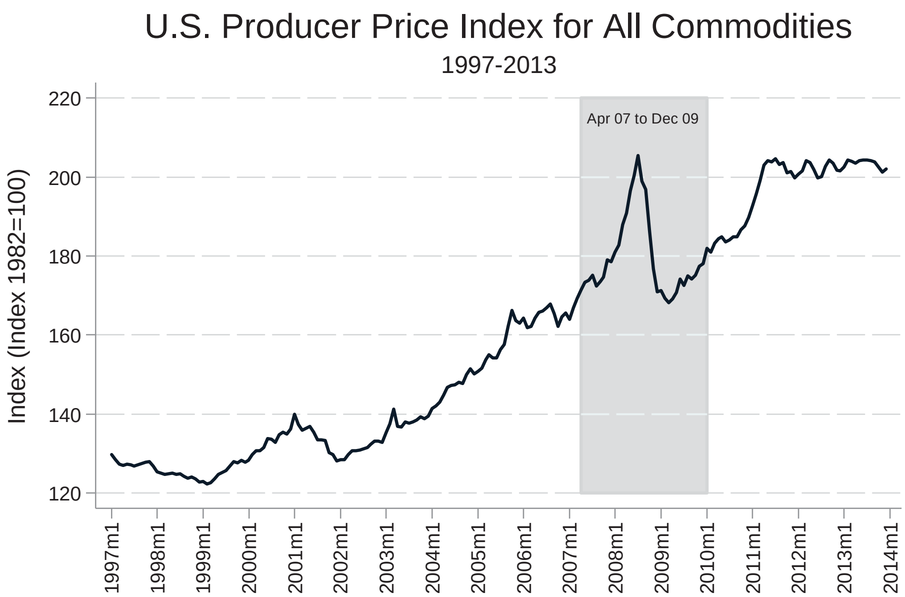
E. The Omission of Data by Ms. Guerin-Calvert Is Not a Legitimate Way to Test Her Inadequately Described Hypothetical

59. Exhibit 1 on page 18 of Ms. Guerin-Calvert's report contrasts the cell damage regression that I have suggested with another regression using only the data outside the April 2007 to December 2009 period. She concludes from this: "In other words, excluding a period of time where tremendous change was occurring in the industry removes any finding of impact on the class."[25] I do not regard this to be a legitimate sensitivity analysis. The proper way to deal with a "period of time where tremendous change was occurring in the industry," is to include variables that capture those changes and then demonstrate that these effects contribute to the statistical accuracy of the model and also substantially reduce the estimated damages. Nothing of this nature has been provided.

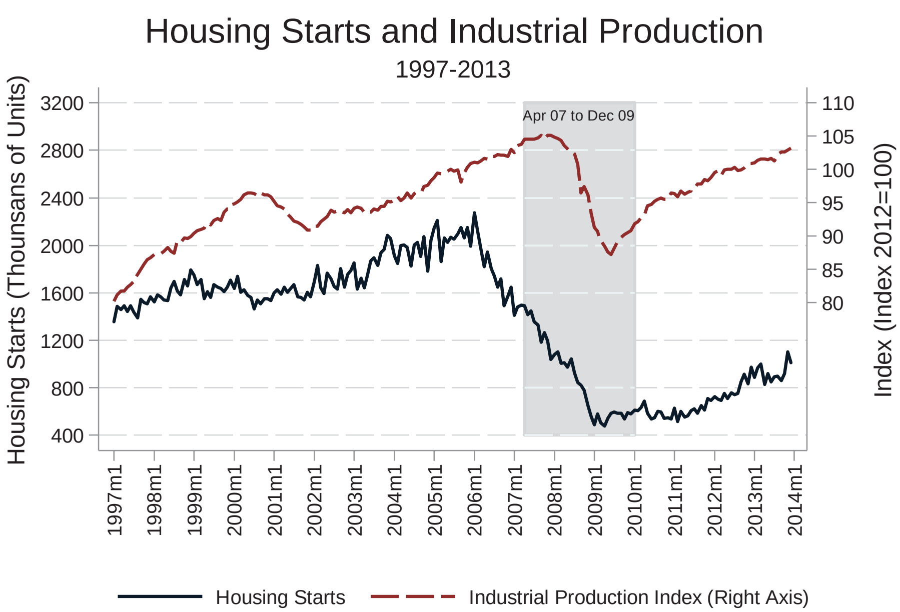
60. For example, I have been particularly puzzled by the pricing power of the LIB manufacturers during the Great Recession from January 2008 to June 2009 when US producer prices overall took a big tumble illustrated in the figure below. This period seems like an ideal test-bed for studying the effectiveness of the batteries conspiracy: When overall producer prices took a sharp dive, could LIB prices remain high? The period of time excluded by Ms. Guerin-Calvert is shaded in this figure – she has omitted the most unusual behavior of the producer prices.

[25] Guerin-Calvert Report, 17.

Figure 7



Source: Bureau of Labor Statistics



Source: Federal Reserve, US Census

61. Rather than excluding this period, I included in my model housing starts and industrial production to capture some macro-economic effects. These series are illustrated in the figure above with Ms. Guerin-Calvert's omitted period shaded. She has omitted the second half of the housing collapse and has also omitted all the collapse and some of the recovery of industrial production. When Ms. Guerin-Calvert excludes the data from April 2007 to December 2009 she forces these effects to be estimated with a data subset which has much less variability in housing starts and industrial production. It is the consequent changes in the coefficients on housing starts and industrial production that are driving her results in her Exhibit 1. If these coefficients didn't change, neither would the coefficient of the conspiracy indicator.

62. I repeat again: I do not regard this to be a legitimate sensitivity analysis. This approach is symptomatic of the generally hypothetical nature of most of Ms. Guerin-Calvert's commentary. Here she floats the hypothesis that April 2007 to December 2009 is "a period of time where tremendous change was occurring in the industry," without studying a single variable that might account for what she thinks is tremendous change. It is not enough merely to provide the list in Ms. Guerin-Calvert's report on pages 16-17 of events that occurred during April 2007 to December 2009 to demonstrate that this was an unusual period. What is needed is first a full timeline of abnormal events including events from 1997 to 2007 and from 2009 to 2014, ideally created by a disinterested party or disinterested procedure, and secondly a method of quantifying the events in a way suited to the damage model, and finally a demonstration that these new variables both contribute to the accuracy of the model and also substantially lower the overcharge estimate. Since none of the events she has listed seem to be substantially correlated with the rise and fall of cobalt prices in this period, it seems to me highly unlikely that this would reduce the overcharge estimate. Certainly, one cannot assume that it would, as Ms. Guerin-Calvert seems to do.

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F. Most of the Data Omissions in My Overcharges Work Are Due to Missing Capacity Information; the Overcharge Estimates are Not Sensitive to These Omissions

63. Ms. Guerin-Calvert makes the correct observation that my overcharge regression is based on a subset of the data but makes an incorrect claim that this means the data I used are not representative of the whole:

> "Dr. Leamer has no basis for assuming that the firm-specific data used in his report to estimate the overcharge and pass-through models are representative of all transactions: For years prior to 2003 the range of the proportion of data removed from the analysis was 16 percent to 32 percent of observations and 15 percent to 39 percent of the quantities depending on the year, and between 5 percent to 10 percent of observations and 4 percent to 14 percent of quantities for the following years."[26]

64. To address this criticism, I explain why these observations were omitted and describe what (little) impact their omission has had on the overcharge equations.

65. Exhibit 3 reports reasons for omissions by year for transactions and Exhibit 4 reports the equivalent information for quantities of cells shipped. The first column of Exhibit 3 reports the number of transactions in each year and the second column the number of omitted transactions. These transactions are omitted because of (1) outlier record, (2) missing number of cells, (3) missing cell vs. pack indicator, (4) missing dimension, (5) quantity of cells not an integer (6) missing cell capacity and (7) 2014 data. My overcharge regressions for cells and packs, reported in Figure 34 of my initial report (repeated here in the first columns of Exhibit 1), have fixed effects for manufacturer, dimension, capacity, and number of cells in packs. In order to accomplish this estimation, each transaction needs to distinguish cells from packs, and needs to indicate

[26] Guerin-Calvert Report, 13.

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manufacturer, dimension, capacity and number of cells for packs. Overall, 7.6% of the transactions are dropped. Missing capacity flags 72.8% of these omitted transactions and outliers flag 23.6%. These account for the vast majority of omissions.

66. The outlier filter that I used removed transactions with prices under the 1st percentile or over the 99th percentile, computed over a year-quarter, dimension and capacity range. In addition to that, any transactions with prices under 30 cents per cell, price over $50 per cell or quantity less than 10 for cell transactions were also removed.

67. Including outliers increases the number of observations in the cell equation from 5,440 to 5,495 and the pack equation from 17,647 to 19,043. I describe in detail the sensitivity of my model to these excluded data (see the discussion of Exhibit 5 and Exhibit 6 below), i.e., how the overcharge regression changes if the outliers and missing observations are included in the data set. The effect of including these observations is to increase the overcharges in all years for both cells and packs.

68. In summary, Ms. Guerin-Calvert should not be complaining about these omissions. The data were dropped for legitimate reasons - because of missing attributes or clear outliers. Including these data does not change conclusions, in fact only shows higher impact (it is therefore conservative to leave out these questionable data).

G. Quantity Weighting is Standard and Allows Each Cell Sold To Have the Same Weight In Estimating Damages

69. The defendants have produced business records indicating 429,221 sales transactions that describe shipments of lithium ion cylindrical cells and cylindrical packs, with the quantities of cells shipped varying across transactions from one to 2.6 million, and the quantities of packs shipped varying from one to 1.31 million. For purposes of estimating a damage pricing model, I have aggregated these data by model and time period (quarterly) into quantity-weighted average prices. The weighting of each transaction by quantity shipped assures that each cell shipped has the same weight in my averages. The same

idea is embedded in my quantity weighted regression model allowing each cell or pack to have the same influence on the estimated model.

70. Ms Guerin-Calvert reports that the damage regression is substantially different if the data are not weighted by quantity. She correctly describes the logic for quantity weighting but she never says that it is the wrong approach for this data set.

> "Using quantity weights is equivalent to re-scaling the data so that each unit purchased is treated as an individual observation. This is typically justified when choices are aggregated up to some level in survey data for example. The analyst may want to "re-capture" the original data set (with the assumption that variance is constant for individuals). In Dr. Leamer's data, however, he has chosen to aggregate up to a weighted average when he could have used more fine-grained data on a transaction-by-transaction basis. By doing so, Dr. Leamer is treating larger purchasers of cells and packs as more representative of the class than smaller ones and periods of large quantities shipped as having more influence on this regression than periods of lower volumes. This choice matters to his results. Dr. Leamer does not justify this modeling choice in any way, but on its face it is not representative for all class members."[27]

71. It is of course possible to estimate a model using transaction level data but this would raise additional econometric questions regarding the effective number of observations that do not arise in my study of averages. But in any case, the weighting issue would arise again in studying transactions. Under Ms. Guerin-Calvert's logic if a single transaction were instead split over two different dates in the same quarter it should be counted twice. This does not make sense because it's the same volume of product at the same price. Further, why should a shipment of 10 cells count as much as a shipment of 8,000,000 cells?

[27] Guerin-Calvert Report, 26-27.

72. Beyond the rhetorical appeal of treating each cell equally, there is an econometric problem that requires quantity weighting: the lower volume transactions are more volatile and thus more noisy and less reliable indicators of market conditions. Econometricians call this problem with a data set "heteroscedasticity," meaning a predictably non-constant amount of noise. The treatment for this problem is putting less weight on the less reliable, more noisy data. Two examples of the effect of the quantity shipped on the variability of prices are illustrated in Figure 8 and Figure 9 below which compare the quantity of Samsung's shipments of two kinds of cells with the corresponding price per cell. Here one can clearly see that there is a lot more dispersion for the low volume shipments.

73. Figure 10 reports regressions that confirm the effect of quantity shipped on the size of the residuals in my overcharge regression. These are regressions of the log of the squared residuals from the unweighted regression on the quantity shipped. The statistically significant negative coefficient on quantity for both cells and packs is calling out for quantity weighting. That's the heteroscedasticity problem.

Figure 8 – Samsung 2200 mAh Cells (2006)

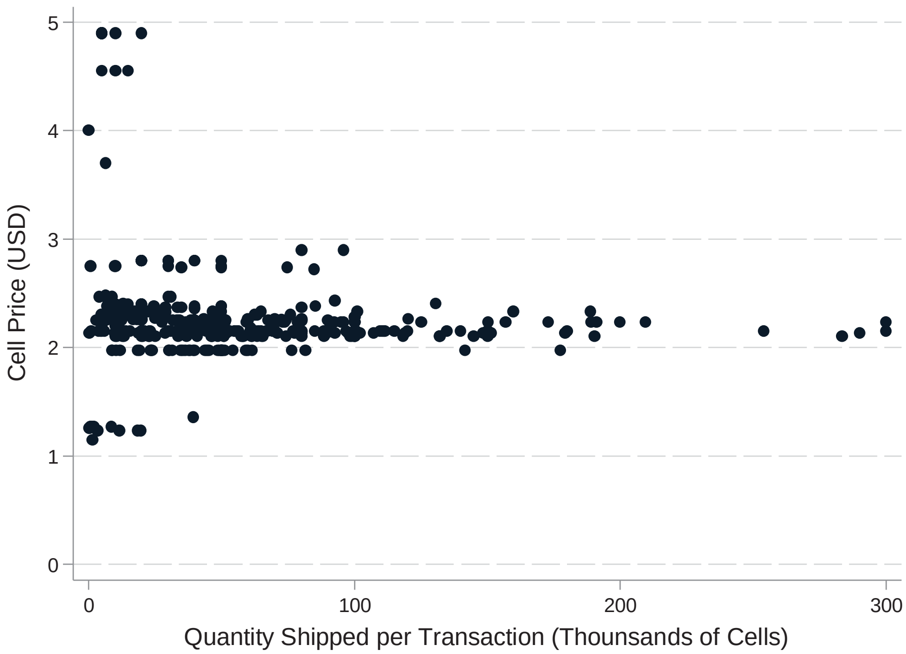

Figure 9 - Sanyo 2600 mAh Cells (2007)

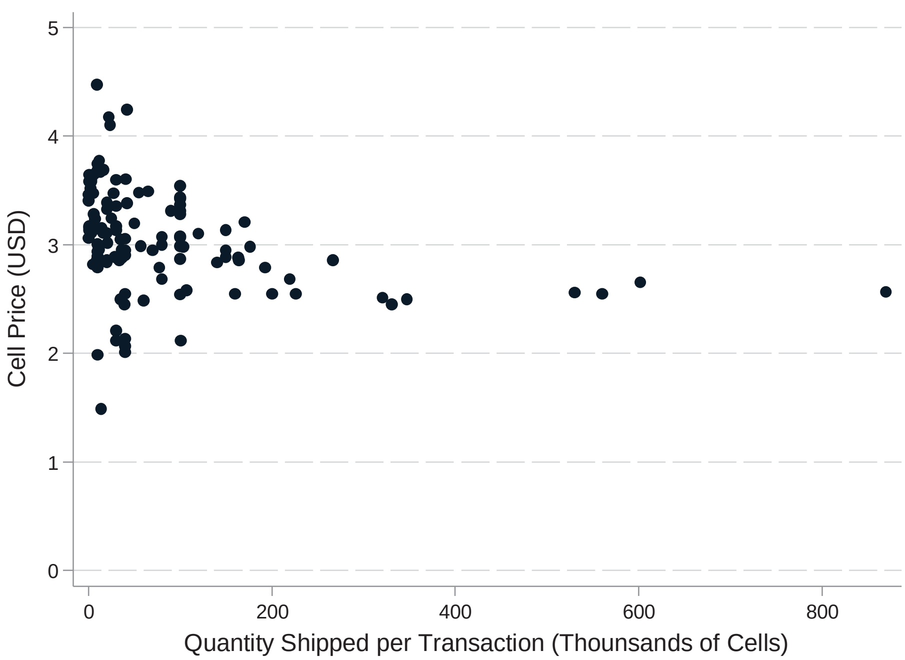

Figure 10

	Cells		Cells in Packs	
Variable	Coeff.	T-Stat	Coeff.	T-Stat
(1)	(2)	(3)	(4)	(5)
Dependent Variable				
Log Residual Squared [1]				
Log (Cell Quantity)	-0.2670 ***	-13.39	-0.1598 ***	-16.26
Constant	-3.8098 ***	-15.68	-5.4967 ***	-53.38
Fixed Effects	YES		YES	
Observations	5,435		17,625	
R-squared	0.188		0.201	

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Residuals from overcharge regression without quantity weights

Source: Leamer Backup

74. The unweighted and quantity-weighted regressions reported in Exhibit 7 and Exhibit 8 confirm that the damages per the cell equation are greatly affected by quantity weights but not so much the pack equation. However, measures of fit are much superior for the quantity-weighted regression, as is to be expected given the correlation between quantities and squared residuals described by the regressions in Figure 10. The bottom line is that quantity weights should be used here.

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H. A Sensitivity Analysis Doesn't Reveal any Major Problems With My Damage Model

75. The building of an econometric model that helps us understand non-experimental economic data involves a large number of somewhat arbitrary modeling choices including what data to use, how to weight the included observations, which variables to include and which functional form. Throughout my career as a theoretical econometrician and an applied data analyst I have been recommending various forms of sensitivity analyses to show how much these choices matter, the goal of which is to separate sturdy from fragile inferences. I have been advocating reporting not just traditional measures of statistical uncertainty, t-values and p-values, but also some organized sensitivity analyses that reveal and measure what I have called "model ambiguity".

76. I believe that legal cases should be seeking clarity about the levels of both statistical uncertainty and also model ambiguity. My initial report sets the stage for a discussion between the experts about both of these. I offered a model that I regard to have an acceptable level of statistical uncertainty and is reasonably insensitive to changes in important modeling choices. Ms. Guerin-Calvert has advised the court that the level of statistical uncertainty as revealed by the p-values is unacceptably large for my cell equation but not my pack equation. I have disagreed with that conclusion. I think the cell equation is up to the task of estimating overcharge with a tolerable level of statistical uncertainty.

77. In this adversarial process, I chose to submit my first report without a sensitivity analysis, because I expected to see attempts to alter my model in the report filed by Ms. Guerin-Calvert, which generally occurs in reports submitted by defense experts in similar circumstances. I was prepared to respond to those suggestions and to offer my own sensitivity results. Together we would have a meaningful assessment of the effects of changes in the model on the damage estimate. I am surprised that Ms. Guerin-Calvert has not pursued the model ambiguity issues in a useful way. She has presented a long list of hypotheticals – events that occurred during the period from April 2007 to December 2009,

which she has operationalized only by omitting all the data from April 2007 to December 2009, something I do not regard to be a sensible study of sensitivity. She has also estimated my model with another huge reduction in the data set by focusing on sales to subsets of manufacturers. This great reduction in sample size has generally had the predictable effect of wild estimates and lower t-values. She has complained that I omitted outliers and also omitted data with missing capacity information, but she has not explored what would happen if these data were included. She has offered a misguided unweighted regression – the only case in which she has shown an effect on the estimated overcharges. That's it.

78. Exhibit 5 through Exhibit 11 constitute a sensitivity study for cells and for cells in packs. Exhibit 5 and 6 deal with the impact of outlier and missing data omissions discussed above. These are further discussed below. Exhibits 7 and 8 report cell and pack models with and without quantity weighting also discussed above. Exhibits 9 to 11 report three more sensitivity studies that deal with model changes identified below for comparison, Exhibit 1 has my original regressions from Figure 34, original Report. At the bottom of these tables is the R-squared (a measure of fit of the regression), and the average overcharge percentage during the class period. This explicitly deals with two concerns in Ms. Guerin-Calvert's list on page 43 of her report (nickel prices and sales of laptops). (Foreshadowing: these don't have much effect)

79. **Include Nickel Prices**: Nickel-metal hydride batteries may have competed with cylindrical LIBs especially in power tools and cameras[28]. That competition is less intense when the price of nickel is high, and high nickel prices should support high prices for LIBs. Accordingly, Exhibit 9 reports overcharge regressions that include the log of the nickel price three and six months lagged, a lag structure conforming with the lag structure of the price of cobalt, the primary metal used in LIBs.

[28] "Is Lithium-ion the Ideal Battery?," Battery University, http://batteryuniversity.com/learn/archive/is_lithium_ion_the_ideal_battery; and "FAQs," Green Batteries, http://www.greenbatteries.com/faqs/.

80. For cell prices the three-month lagged nickel price coefficient is positive (0.023) and highly statistically significant (t=5.471), a result that supports the hypothesis that nickel based batteries competed with LIBs. This has the effect of moderately lowering the estimated overcharge outside the period of enhanced cobalt price sensitivity but raising the overcharge during that period, slightly increased average overcharges on cells from 18.624% to 18.632%. The average overcharges on packs slightly reduced from 13.934% to 13.315%.

81. **Include Global Notebook Sales**: An unexpected surge in sales of finished products that use LIBs could push the battery producers up against capacity constraints and lead temporarily to higher prices, and unexpected weakness in growth of sales of these finished products could increase the intensity of competition and lower battery prices. Accordingly, Exhibit 10 reports overcharge regressions that include the log of Global Notebook shipments, current and lagged one quarter. The cell equation has a statistically significant positive effect of the current level of Global Notebook shipments and a less statistically significant negative on the lagged value, together supporting the conclusion that high rates of growth of Global Notebook shipments contribute to high battery prices. But this change in the model actually increases the average damage to 18.805%. The pack model has a modestly significant positive coefficient on the current level of PC shipments, which has the effect of slightly reducing average overcharge for 13.934% to 13.916%.

82. **Eliminate the Heighted Cobalt Sensitivity Period**: Although this is not something I would do in the context of a sensitivity analysis, in deference to concerns raised by Ms. Guerin-Calvert in her paragraphs 43 and 44, I include Exhibit 11 which shows what happens if the cobalt sensitivity is assumed always to remain constant.

83. The reason I do not regard this to be a sensible sensitivity analysis is because it creates a model that is inconsistent with the documentary records. Among the documents that support a period of heightened sensitivity to cobalt prices is the Statement from Yasushi Matsumoto at Panasonic:

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> "The incident was a result of my action that, during 2008, in the wake of the price hike of cobalt raw material, in the effort of overcoming the financial difficulties that the company was facing to, I participated to or instructed to participate in the several meetings with competing companies, including Sanyo Electric Co., Ltd. at the time, for the purpose of raising prices, coordinating and promoting such idea across the industry and making an agreement among them."[29]

84. For cells, the elimination of the enhanced cobalt sensitivity period modestly increases the level and statistical significance of the coefficient on the conspiracy indicator, and it reduces average overcharges from 18.624% to 6.186%. For packs, it leaves the coefficient of the conspiracy indicator pretty much unchanged, but it reduces average overcharge from 13.934% to 4.809%.

85. While substantially reducing the average estimated overcharge, these models do not fit the data nearly as well as the original model. The t-values in the original model for these two dropped variables are -2.693 and 4.072 in the cell equation and -4.685 and 6.527 in the pack equation. In other words the data want a period of heightened cobalt sensitivity. In terms of its impact on damages, this case and the quantity weighting case are the only two that are genuinely material. I have argued above that the quantity weighting that I have used is both logical and supported by the data evidence. In the case of the heightened sensitivity to cobalt prices it is the documents and the data that both strongly support the overcharge model that I have used. I think the documents want the same model feature.

86. **Keep Outliers; Keep Data With Missing Capacity.** My cell model is estimated using 5,440 observations selected from a total of 6,273, and my pack equation uses 17,647 observations selected from a total of 20,456. As noted above, these observations were omitted first because they lack capacity data

[29] SANYO0670266.

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and secondly because they constituted extreme outliers in the distribution of prices.[30] Exhibit 5 and Exhibit 6 show what happens if the outliers are included and what happens if the missing capacity data are included. In order to continue to have fixed effects for capacity when some of the capacity data are missing, we are compelled to include a fixed effect for the category "missing."

87. Adding these extra data points generally increases the statistical significance of the coefficients (increases the t-values) which I suppose will please Ms. Guerin-Calvert. But the overall fit of the model naturally deteriorates when the unusual or incomplete observations are forced into the estimation process. The average estimated overcharges when the outliers are included but when the observations with missing capacity are forced into the model increases from 18.624% to 21.182% for cells and increases from 13.934% to 14.815% for packs.

88. Based on these results reported in Exhibits 5 to 11, my preferred model is not sensitive or fragile to reasonably alternative models, and model ambiguity therefore is not a big issue.

IV. Pass-Through Work

A. SEC Filings Reveal Why these Firms Conspired: It's Not Lack of Information; It's Too Much Competition

89. Ms. Guerin-Calvert says "Another reason an overcharge in costs may not be passed-through is because firms do not have perfect information, and therefore do not know immediately whether a given cost increase is specific to them or an industry-wide increase."[31] That strikes me as implausible for the

[30] As described in my earlier report, "I utilized an outlier filter which removed transactions with prices under the 1st percentile or over the 99th percentile, computed over a year-quarter, dimension and capacity range. In addition to that, any transactions with prices under 30 cents per cell, price over $50 per cell or quantity less than 10 for cell transactions were also removed. These filters result in fewer than 2 percent of transactions being removed." Leamer Report, 81-82.

[31] Guerin-Calvert Report, 32.

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circumstances in this case. The SEC filings[32] that are Ms. Guerin-Calvert's only support for this idea discuss a variety of increases of raw material prices that are surely in the public domain. Nothing in these quotations from SEC documents suggests a lack of information. The quotes in footnote 74 mostly lament the highly competitive marketplaces into which these producers sell their products. HP refers to "competitive pricing pressures"; Black and Decker: "significant global competition"; "The markets in which we sell products are highly competitive." Illinois Tool Works: "competitive pricing pressure." Robert Bosch: "We therefore regard it as our prime task to work systematically on reducing costs and on improving competitiveness in some operating units that are particularly under pressure." Indeed, 100% pass-through of cost changes is a hallmark of highly competitive consumer product markets like these.

B. Random Sampling Is Not an Option For Collecting Information About Pass-Through Rates

90. In section V, Ms. Guerin-Calvert seems to suggest that my summary of estimated pass-through rates that have occurred in a variety of settings is not informative about the pass-through of battery price increases into finished product prices because I did not choose products or firms with either "random" sampling or "purposive" sampling, but instead used a "convenience" sample, meaning in my case everything I could get my hands on. I never suggested that the data sets I studied were a random sample from any population, but the evidence presented nonetheless sheds light on the pass-through question.

91. Here is some relevant material from Ms. Guerin-Calvert's report:

> 121. It is useful to examine representativeness from the perspective of statistics, and concepts of survey samples. While there are alternative strategies, there are two general categories of methods to establish a

[32] Guerin-Calvert Report, 33.

representative sample. The first is typically called random sampling and involves the design of a sampling method to help assure a random draw of the population (in this case, for example, of firms at each level of the distribution chain) so any statistics drawn from the sample can be used to make inferences about the population. Design of the survey is conducted prior to the actual analysis of the data. Designing and "drawing" a representative random sample involves sampling observations with variation across any of the important variables that are likely to result in a different measurement of interest. From this defined universe of characteristics, firms would be randomly selected and data from those firms could be developed. A second approach is called purposive selection or a judgment sample. This represents choice of a sample to elicit the key characteristics of the population. The person designing the sample uses judgment to choose a set of firms known to be representative of classes of individuals such that any statistics drawn from the chosen sample (possibly with known bias corrected for) could be used to draw inferences about the population. Both methods involve appropriate design before the sample is gathered. The alternative to this process, which is starting with a given dataset, is that the data may be the result of a "convenience" sample, which generates bias. After-the-fact justification of samples has known issues with bias and precludes proper inferences.

125. At the retail level for notebooks (one of the larger samples) Dr. Leamer has a total of 6 notebook retailers. Two of which, using his average cost methodology, yield pass-through estimates which do not contain 100 percent (his 100 percent pass-through "rule") – CDW and PCM. Yet Dr. Leamer insists that he has no reason to question his "rule." Even putting this aside for the moment, Dr. Leamer is inferring from 6 retailers studied that he can conclude that the population of over 26,000

> firms in the electronics and appliance store space he did not study would have similar rates of pass-through. Dr. Leamer also does not analyze any of the 32 firms selling products in the U.S. that are classified as warehouse clubs and supercenters accounting for $421M in total retail sales across more than 5,000 stores including some of the nation's largest retailers, Wal-Mart, Target and Costco, but he insists that he can infer from his limited study of online firms, electronics and hardware stores their pass-through rates would also be 100 percent.

92. If Ms. Guerin-Calvert is offering the opinion that the pass-through cases that I have studied do not constitute useful evidence, this is wrong. Random sampling is not the only way to gather useful information and it is hard to imagine a court excluding all data not collected with random sampling. In that event, there wouldn't be much left.

93. A "random" sample is designed to assure that the sample is representative of the population from which it is drawn in a precise mathematical sense. It is essential for this form of representativeness to have a known probability of being included in the sample for each and every member of the population. A simple random sample has the inclusion probabilities all the same, but there are other random sampling methods that favor some members, for example, stratified random sampling. In contradiction to the apparent statement of Ms. Guerin-Calvert, a "purposive" sample cannot have the mathematical representativeness properties unless the "purpose" allows known probabilities of sample inclusion, which doesn't seem to fit her description. If the inclusion probabilities are not known and under the influence of the analyst, both a "purposive" sample and a "convenience" sample are not mathematically representative of the population from which they are taken, and the extent to which they are nonetheless representative is a matter of judgment. Apparently, Ms. Guerin-Calvert regards a "purposive" sample as representative, for reasons that remain unstated, while a "convenience" sample is not representative. It strikes me that a "purposive" sample could be purposively biased while a convenience sample is only accidentally biased. In both cases, it requires

wisdom and judgment applied carefully to the context to determine the extent and direction of the bias. Vague words like "purposive" and "convenience" are not useful.

94. While a pristine random sample is a worthwhile goal, real samples usually suffer from non-response problems, and whether these samples are representative or not depends on judgments regarding the extent to which non-responders are different from responders. In other words, this is an academic discussion. The real world requires judgment and wisdom to interpret evidence. In my deposition, I suggested that a finding that a drug has adverse side effects for twenty percent of economists would make lawyers wary even though there had been no chance of including a lawyer in the trial.[33]

95. Moreover, while the subject of "Statistics" concentrates on drawing inferences from data created by randomized controlled experiments, the subject of "Econometrics" concentrates on drawing inferences from "observational" (non-experimental) non-random data. For example, the level of education is not randomly chosen, and an econometric question is how to properly adjust the correlation between earnings and education to take into account that the more able people are likely to get more education.

96. Putting aside this highly academic discussion, we need to confront the fact that the availability of data sets that can help estimate the rate of pass-through is very much influenced by the ability and willingness of firms to provide relevant business records. In this setting, "random" is certainly not an option for sample design. I do not know what would be Ms. Guerin-Calvert's advice in this setting.

97. My interpretation of the evidence of pass-through relies on the bedrock assumption of economics that firms must charge enough to cover their costs, or they are forced to go out of business. That doesn't mean necessarily a one-to-one relation between costs and product prices, since economic theory provides reasons why the pass-through could be 100%, less than 100% or

[33] Leamer Deposition at 57:4-25.

more than 100%. A 0% pass-through is a theoretical possibility occurring in a competitive model when the cost increase is suffered by a small fraction of suppliers who do not have the power to affect the market price. This 0% pass-through possibility can be ruled out in the case of LIB battery overcharges because every seller of products that use LIB batteries is affected when the price-fixing conspiracy was operating effectively, not just a few. The existence of nickel-metal-hydride batteries as substitutes in some applications might reduce pass-though, but possibly not below 100% and certainly not to 0%, since LIB and NiMH batteries are not perfect substitutes. The retail focal-point argument, which I discuss at length below, does not raise doubt about the long-run relationship between costs and prices, but it does in one theoretical setup allow some timing separation between the increase in costs and the increase in retail prices. A theory, which I also discuss below, allows product design to fit the focal price points, and allows immediate pass-through at the moment of product introduction, and therefore all or almost all class members would be affected.

98. The central hypothesis that emerges from the economic theory is a long-run pass-through rate at or close to 100%. If there were no relevant evidence, I would suggest that we use 100%. I therefore look to the data for evidence that the long-run pass-through rate of various costs is consistently above or consistently below the 100% rate. I also look for evidence regarding why some rates are high and some are low. The goal is to find pass-through estimates for LIBs that wisely use as much evidence as possible.

C. The Design of Products for Sale at Focal points Assures that Battery Costs Affect the Quality-Adjusted Price of the Finished Product

99. Ms Guerin-Calvert claims that "under [a focal point pricing] strategy, a firm may assign products with similar costs the same price point, despite the cost differences, and, similarly, may not increase the price of a product in response to a relatively small increase in cost. For example, if a seller prices a digital video camera at $199.99 and the price of the battery component is $5, if the price of the battery increases by 20% ($1), the seller may not increase the price

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above the $199.99 focal price because it would mean pricing the camera at $200.99"[34] I note that she offered a pure hypothetical ("may not increase") and has not provided any empirical evidence or academic studies to support this notion and she has implicitly assumed away the product design to fit the focal points.[35] Real life is a lot more complex and doesn't have the kind of focal price points that Ms. Guerin-Calvert hypothesizes.

1. *Retail Prices Offer a Lot of Options Other than Focal Points*

100. Ms. Guerin-Calvert's unrevealed focal point theory seems to refer to a single product in a retail display with few close substitutes, but when it comes to consumer electronics, pricing has to take into consideration many close competitors, multiple choices at multiple bricks and mortar retailers and multiple Internet sites offering multiple products. This allows clusters of prices that are close, but not necessarily single focal points. For example, Amazon on August 16, 2016, offered cordless electric drills from different sellers for $369.99, 316.09, 300.00, 299.99, 220.32, 199.99, 193.50, 167.66, 165.98, 159.00, 149.00, 144.99, 144.99, 129.00, 129.00, 129.00, 104.00, 109.99, 99.97, 99.00, 99.00, 89.00, 89.99, 89.00, 87.31, 86.25, 79.99, 70.17, 69.99, 69.99, 69.99, 69.95, 63.99, 60.90 60.56, 59.99, 58.00, 55.97, 54.99, 54.69, 53.83, 52.99, 50.99, 50.99, 39.86, 36.50, 36.45, 32.00, 25.18, 24.97, 24.74 23.70, and 19.99. This wide range of prices seems to leave a lot of room for passing on changes in costs.[36]

2. *With Fixed Focal Prices, Quality Competition Substitutes For Price Competition*

101. In addition to the great variety of prices that the real world offers, the real world offers the opportunity to design a product suited to sale at the focal

[34] See Guerin-Calvert Report, 35-36.

[35] The only support provided are a few non-academic articles published in non-peer-reviewed publications discussing the possibility of this strategy (see, for example, *Deng, et al. (2011)* listed in Guerin-Calvert Report footnote 85). Another piece of evidence she offers is Best Buy's sales of a single notebook product in one month, which was sold at mainly two prices $849.99 and $999.99. See Guerin-Calvert Report, 35-36.

[36] "Cordless Drills," Amazon, www.amazon.com.

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point. Through that design option, the existence of a focal point supplements price competition with quality competition, which means that damages take the form of lower quality for the same price.

102. The Best Buy website on August 7, 2016 offered 131 new laptops ranging in price from $129.99 to $499.99. Within the list of prices are some price clusters/concentrations. For example, there are eight products (Dell(3), Lenovo(3), HP(2), Microsoft(1)) for sale at $499.99. A screen-shot of the website is displayed in below.

Figure 11

103. Manufacturers aware that Best Buy is intending to sell an array of laptops at $499.99 will need to compete for slots on the retail shelf by designing products suited to that price and inclusive of features that are comparable to other

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similarly priced notebooks. Whatever the features included, their total cost must be compatible with a $499.99 retail price, which means there must be a suitable retail margin and also a suitable margin over cost for the manufacturer to allow some profit. An "under-featured" laptop cannot compete well with other laptops at the $499.99 price and an "over-featured" laptop would cost so much that it would take away the manufacturer margin or the retail margin or both. That means that if the cost of a battery in the laptop is increased, either because a better quality battery is chosen or because a conspiracy successfully increases the price, then the cost of other features has to be reduced to keep the overall costs compatible with the sale price of $499.99. The way to reduce the cost of the other features is to choose lower quality. In other words, product design assures that the quality-adjusted price of any finished product will be increased by a conspiracy that keeps battery prices higher than they otherwise would have been. With focal pricing, competition occurs in quality in addition to price.

104. Figure 12 shows the range of available major cell capacities used in notebooks and camcorders and their weighted average prices in each year between 2000 and 2010. It is apparent that at each point in time, there was a quality hierarchy of different capacities and prices available to the manufacturers. For example, in 2004, a manufacturer could choose between a 1,800mAh cell for $2.23, a 2,000mAh cell for $2.57 ($0.34 higher), a 2,200mAh cell for $2.67 ($0.44 higher), 2,400mAh cell for $2.99 ($0.76 higher), 2,555mAh for $3.44 ($1.21 higher), or any combination of those capacities. My damages model estimated an average overcharge of $0.36 on the LIB cells and $0.51 on cells in packs. Hence, absent the conspiracy, if an LIB cell was $0.36 cheaper and a seller could substitute for a higher capacity battery to keep the total cost constant and sell it at the desired focal price. The implication of this is that, even if the nominal prices of the finished products absent the conspiracy were the same, the quality-adjusted but-for prices would be lower, resulting in the 100% pass-through of the damages in cells to the final consumers.

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Figure 12: OEMs Had Available Different Capacities at Different Prices When Designing Their Products

Available Cell Capacities and Weighted Average Prices by Year During Conspiracy Period
Cylindrical 18650 LIB Cells

Cell Capacity	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
1050					2.52	2.12	1.93	1.82	2		
1080				2.55	2.61	2.62	2.27	2.11	2.41	2.41	2.1
1100						1.99	1.89	1.84		2.21	2.02
1280								2.68	3.06	2.94	2.37
1300						1.97	1.93	1.97	2.29	2.11	1.96
1340										2.37	2.14
1418	5.05	3.51									
1500	3.74	2.72	2.67							2.7	2.29
1600						3.8	3.22	3.06	3.77	2.89	2.36
1630				2.84							
1650	2.88	2.63	2.55	2.43							2.5
1680	3.11	2.63	2.44								
1700	2.55	2.54	2.41								
1785	3.24	2.75	2.44	2.38	2.19	1.83					
1800	2.44	2.53	2.34	2.31	2.23	2.02					
1825	3.61		0.48								
1848	3.18	2.68	2.58								
1950			2.43								
1960		2.71	2.38		2.32	1.98	1.99				
1995		2.77									
2000		2.78	2.56	2.49	2.57	2.07	1.96	2.05	2.58	2.12	1.62
2050						1.85	1.89	2.02	2.36		
2100		2.52	2.69								
2121						2.24	2.17	2.19	2.69		
2150				2.6	2.56	2.26	2.26	2.55	3.05	2.71	
2200			2.6	2.64	2.67	2.33	2.25	2.35	2.81	2.03	1.65
2250						2.33	2.17	2.3	2.56	2.15	1.9
2350					2.92	2.65	2.53	2.62	3.15	2.74	2.24
2400					2.99	2.67	2.51	2.56	3.1	2.65	2.54
2450							2.83	2.85	3.12	2.67	2.96
2550							3.11	3.17	3.89	3.56	3.63
2555					3.44	3.22	3.15				
2600						3.05	2.93	3.12	3.76	2.66	2.05
2800									4.73	3.29	2.67
2900										3.54	3.06
3000										3.61	3.32
3100											3.68

Note: Capacities that account for greater than 0.05% of sales in each year.

Source: Defendant transactional sales data.

105. OEMs have a vast array of other parts that can be adjusted to keep the introductory cost price the same. Figure 13 shows how HP would introduce notebooks with improved features, such as microprocessor, video graphics card, or optical disk at the same price point of $449.99. The result, again, would be a lower quality-adjusted but-for price for the end-users purchasing these laptops absent the conspiracy.

Figure 13

HP Price Point and Quality Over Time
Improvements in HP/Compaq Presario Laptop Models First Sold at $499.99 Price Point at Best Buy

Product Name Month Introduced	C304NR September 2006 (1)	C571NR June 2007 (2)	C714NR September 2007 (3)	C762NR May 2008 (4)
Intel Microprocessor	1.6 GHz Intel® Celeron® M Processor 420	1.73 GHz Intel® Pentium® Dual Core processor T2080	1.46 GHz Intel Pentium dual core processor T2310	1.73 GHz Pentium Dual-Core Mobile Processor
Microprocessor Cache	1 MB L2 Cache	1 MB L2 Cache	1 MB L2 Cache	1 MB L2 Cache
Memory	512MB DDR2 System Memory (2 Dimm)	1024 MB DDR2 System Memory (2 Dimm)	1024 MB DDR2 (2 Dimm)	1024 MB
Video Graphics	Intel Graphics Media Accelerator 950	Intel Graphics Media Accelerator 950 (shared)	Intel Graphics Media Accelerator X3100 (shared)	Intel Graphics Media Accelerator X3100
Hard Drive	80GB 5400RPM (SATA)	80 GB (5400 RPM) Hard Drive (SATA)	120 GB (5400 RPM) Hard Drive (SATA)	160 GB (5400 rpm)
Multimedia Drive	24X DVD/CD-RW Combo Drive	Super Multi 8X DVD±R/RW with Double Layer Support	Super Multi 8X DVD±R/RW with Double Layer Support	LightScribe Super Multi 8X DVD±R/RW with Double Layer Support
Display	15.4" WXGA High-Definition BrightView Widescreen (1280 x 800) Display	15.4" WXGA High-Definition BrightView Widescreen (1280 x 800) Display	15.4" WXGA High-Definition BrightView Widescreen (1280 x 800) Display	15.4" WXGA High-Definition BrightView Widescreen (1280 x 800) Display

Notes: (1) Green shading indicates performance improvement
(2) t2310 is higher performance than t2080.See http://www.cpu-world.com/Compare/469/Intel_Pentium_Dual-Core_Mobile_T2080_vs_Intel_Pentium_Dual-Core_Mobile_T2310.html

Source: BBYLIB0000441, BBYLIB0000443, BBYLIB0000445, BBYLIB0000447

3. *Bundling with "Free" Add-ons Allows Price Reductions Without a Change in the Retail Price*

106. Note that Best Buy website depicted above has included with each of these $499.99 laptops one or two "free" items, which means the effective cost is actually less than $499.99. That option greatly reduces the force of the focal point hypothesis since it allows for the sale of products at prices that are effectively lower than the focal list price.

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4. Focal Prices Do not Last Long

107. Furthermore, the [redacted] transactional data reveals that laptops that are introduced at selling prices ending in 9 are frequently sold at the same store at a different price within 30 days of the original sale. In other words, "focal" doesn't mean "fixed." These [redacted] data comprise sales prices of laptop computers distinguished by model and by selling store. This allows us to track the prices of the same laptop at the same store after the first or introductory price at that store. As shown in Figure 14, there is a distribution of introductory prices ending in $9, e.g. $09, $19, $39. [redacted] introduces most Notebooks at prices ending in $99 or $49. However, overall 46% of [redacted] sales of the products listed at these initial prices are sold at the same store at prices different from the introductory price within the first 30 days of the sales.

Figure 14

[redacted] Price Adjustments in a Store within First 30 Days of Sales
Laptops (2002-2011)

		Store-Models	Share of Store-Models	Percentage of sales made at prices other than the introductory store price
		(1)	(2)	(3)
1.	Introductory price ending in 09	27	0 %	60 %
2.	Introductory price ending in 19	3,004	0	77
3.	Introductory price ending in 29	42,852	4	43
4.	Introductory price ending in 39	1,127	0	92
5.	Introductory price ending in 49	307,932	27	46
6.	Introductory price ending in 59	1,132	0	69
7.	Introductory price ending in 69	1,671	0	59
8.	Introductory price ending in 79	79,204	7	40
9.	Introductory price ending in 89	1,947	0	48
10.	Introductory price ending in 99	513,345	45	42
11.	Other prices	176,143	16	63
12.	**Total number of store-models**	**1,128,384**	**100 %**	**46 %**

Notes: (1) All prices in this analysis are based on the integer of the observed price, so, for example, the prices $999.99 and $999.98 are both treated as $999
(2) Introductory price is the most frequently observed price on the first day a computer model is sold

Sources: Best Buy POS Data.

D. Ms. Guerin-Calvert's Exhibit 12, Which Reports Correlations of Monthly Changes in Battery Costs and Total Costs For Cases of "Small" Cost Change, Is Misleading and Irrelevant For Multiple Reasons

1. The Historical Correlation Between Battery Prices and Total Costs Tells Us Nothing About the Pass-Through of Battery Prices

108. Paragraph 106 of Ms. Guerin-Calvert's report discusses correlations between changes in battery prices and changes in total costs, restricted to small changes in total costs. From these correlations reported in her Exhibit 12, she concludes "In other words there appears to be no foundation for the

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assumption that movements in cell prices are reflected in standardized cost of finished products."[37] Her Exhibit 12 includes data from nine OEMs.

109. Can we not proceed on the assumption that OEM total costs properly measured include costs of all components including batteries? With the assumption that total costs are the sum of battery costs and other costs, I am inclined to say that battery costs are by definition "reflected" in total costs, though I am not sure what Ms. Guerin-Calvert means by that word.

110. But the fact that battery prices are part of total cost does not mean that battery prices are positively correlated with total costs. Using the assumption that OEM total costs are equal to battery costs plus other costs, the size and sign of the correlation between battery prices and total costs depends on the relative size of the variances of battery costs and other costs, and the correlation between them. Battery prices and total costs can have a negative correlation if other costs are negatively correlated with battery prices (for example if battery prices are increasing while other component prices are decreasing). There is consequently no reason to look at these correlations to determine if battery prices are part of total costs.

111. It may be that Ms. Guerin-Calvert supposes that battery overcharges are not passed on to finished product prices if historical actual battery prices have zero or negative correlations with historical total costs, even if total costs are known to be passed on. This is an incorrect conclusion from that correlation. In the but-for world with lower battery prices, total costs would be lower than the actual total cost, never mind the historical correlations. The pass-through of these lower total costs thus implies that the prices of finished goods would be lower also. The correlation of historical battery prices and total costs is irrelevant.

[37] Guerin-Calvert Report, 52.

2. Correlations Between Battery Prices and Total Costs Should Not be Expected In Part Because Battery Prices Cannot Be Matched With the Finished Product

112. For retailers and distributors, the issues relating to correlation of battery prices and total costs are more extensive. Retailer total costs include the wholesale price of the finished product, inventory costs, labor costs, rents and website creation and maintenance. Here the failure to see a relationship between total costs and battery prices can come from four sources: (1) The battery price has a zero correlation with OEM total costs per the discussion above. (2) The OEM does not pass on changes in total costs. (3) the acquisition price of the finished product is not properly measured, or (4) the battery price is mismeasured.

113. There is a lot that can go wrong here, but there is a huge problem with battery prices because it is impossible to know what specific batteries were used in the products referred to in Ms. Guerin-Calvert's Exhibit 12. It is very surprising that the battery price that Ms. Guerin-Calvert uses to calculate the correlations in Exhibit 12 is the monthly quantity-weighted average of all cell prices or all pack prices, which is exactly the same for each and every row of her table, thus exactly the same battery prices for Distributors, OEMs, and Retailers, which are at different points in the supply chain, and exactly the same battery prices for every business no matter the product involved. Thus the retailers, Home Depot and PC Connection, have the same battery prices, ignoring completely the differences in their product mixes, and for the distributors, ASI and Ingram, the same battery prices are assumed for Camcorders and for Cameras and for Notebooks.

114. In addition, each row of this table refers to a collection of different products. Instead of studying any particular product, she uses the quantity weighted average of all products for which costs have been provided. Moreover, she reports only correlations to the records that exhibited under 5% monthly cost change.[38]

[38] Guerin-Calvert Report, 53 (Exhibit 12).

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115. None of this would matter if there were only one battery, but if you are looking for evidence of the battery price in total costs of a specific products, your greatest chance of finding that would be to compare the price of the battery used in the product with the reported cost of that product. It would be astonishing if Ms Guerin-Calvert had found any meaningful relationship between the series that she used.

116. Also the correlations of changes presented by Ms. Guerin-Calvert do not deal with the probable way in which changes in costs are folded in over time into changes in prices as occurs with the dynamic models that I have estimated. Ms Guerin-Calvert performed correlations in price levels (not changes) and did find a predominantly positive relationship between general cell price levels and finished product prices, which is displayed in Figure 15 below. Some combination of the correlations of changes and levels as implied by an explicit dynamic model is the best way to summarize these data.

Figure 15

Monthly Correlations of Cell and Pack Prices with Product Cost

			Cell Prices				Pack Prices			
Product	Company	Level	Contemporaneous	1 month Lag	3 month Lag	6 Month Lag	Contemporaneous	1 month Lag	3 month Lag	6 Month Lag
Camcorder	Ingram	Distributor	0.57	0.54	0.44	0.30	0.65	0.63	0.58	0.51
Camcorder	Sony	OEM	0.56	0.56	0.54	0.52	0.80	0.80	0.78	0.75
Camcord	[redacted]	Retailer	0.66	0.66	0.62	0.55	0.68	0.66	0.59	0.48
Camcorder	PC Connection	Retailer	0.48	0.45	0.43	0.40	0.76	0.75	0.75	0.75
Camcord	[redacted]	Retailer	0.73	0.70	0.62	0.50	0.65	0.61	0.54	0.42
Camera	Ingram	Distributor	0.15	0.14	0.12	0.12	0.45	0.45	0.43	0.41
Camera	Sony	OEM	0.49	0.49	0.48	0.48	0.74	0.74	0.73	0.70
Camera	ABC Warehouse	Retailer	0.45	0.47	0.64	0.84	0.48	0.55	0.64	0.76
Camera	CDW	Retailer	0.38	0.39	0.31	0.35	0.38	0.37	0.33	0.45
Camera	[redacted]	Retailer	0.01	-0.04	-0.20	-0.33	-0.15	-0.18	-0.28	-0.41
Camera	PC Connection	Retailer	0.22	0.22	0.21	0.23	0.56	0.56	0.57	0.59
Camera	[redacted]	Retailer	0.47	0.45	0.41	0.39	0.44	0.42	0.38	0.33
Notebook	ASI	Distributor	0.35	0.32	0.24	0.12	0.37	0.34	0.30	0.27
Notebook	Ingram	Distributor	0.40	0.38	0.33	0.23	0.67	0.65	0.60	0.53
Notebook	SED	Distributor	-0.06	-0.08	-0.14	-0.26	0.37	0.36	0.28	0.18
Notebook	AOpen	OEM	0.44	0.47	0.42	0.47	0.43	0.38	0.36	0.39
Notebook	Acer	OEM	0.64	0.66	0.60	0.50	0.39	0.36	0.23	0.13
Notebook	Dell	OEM	-0.06	-0.06	-0.07	-0.11	0.42	0.41	0.37	0.27
Notebook	Fujitsu	OEM	0.38	0.39	0.42	0.46	0.36	0.37	0.37	0.35
Notebook	Sony	OEM	0.57	0.56	0.54	0.52	0.76	0.75	0.73	0.72
Notebook	Toshiba	OEM	0.37	0.36	0.36	0.30	0.76	0.75	0.75	0.73
Notebook	Amazon	Retailer	0.52	0.54	0.58	0.63	0.57	0.55	0.59	0.67
Notebook	CDW	Retailer	-0.09	-0.04	0.08	0.06	-0.02	0.01	0.00	-0.15
Noteboo	[redacted]	Retailer	0.65	0.60	0.46	0.28	0.54	0.50	0.37	0.20
Notebook	PC Connection	Retailer	0.46	0.45	0.43	0.43	0.77	0.76	0.76	0.76
Noteboo	[redacted]	Retailer	0.33	0.32	0.29	0.23	0.28	0.26	0.21	0.15
Power T	[redacted]	OEM	0.42	0.41	0.36	0.25	0.55	0.55	0.52	0.44
Power Tool	ACE Hardware	Retailer	0.73	0.72	0.74	0.74	0.75	0.78	0.77	0.75
Power Tool	Home Depot	Retailer	-0.63	-0.61	-0.62	-0.67	-0.70	-0.67	-0.68	-0.73

*Calculated using Leamer "actual" cell and pack prices from "Figure_34_36_Data4Reg" correlated with the monthly aggregated company-product cost from Leamer Figure 40 Regressions (figure_40_41_data4reg). Best Buy data is annual and thus dropped from analysis.

***Orange Cells Show Positive Correlations**
***Red Cells Show Negative Correlation**

3. *"Small" May Mean Large Measurement Errors, Not Necessarily Changes in Battery Prices*

117. There is another big problem here: the OEM cost is the sum of a large number of material costs and labor costs, some of which are rising and others falling. The acquisition cost for retailers and distributors is the sum of all these costs plus an OEM margin, filtered through a pass-through relationship. The change in this total cost is small when the positive changes are offset by negative changes, not when battery prices are necessarily changing. Indeed, most battery price changes will occur when overall cost changes (which includes battery cost) are large not small, which means that there is no justification to limit focus on pass-through to small changes in total cost, (monthly price changes between 0.1% and 5%) On the contrary, small changes in total costs may be more susceptible to measurement errors, making it all the more difficult

to find a correlation with battery prices. In my regressions, the effect of measurement errors would result in a downward bias, or understatement, of the pass-through coefficient for this category. In Ms. Guerin-Calvert's analysis these measurement errors would bias the correlation coefficients towards showing no relationship.

4. Ms. Guerin-Calvert's Study of Correlations of Battery Prices and Total Costs Has Econometric Flaws

118. The correlations reported in Exhibit 12 also suffer from an "overlapping data" econometric problem. Exhibit 12 reports correlations over four different time periods. All but the contemporaneous correlation are computed with "overlapping" samples. For example, the six month change is the sum of six monthly changes, and the six month change one month later uses five of those changes again. The use of overlapping samples causes correlations that need to be (but were not) dealt with. In addition, this display leaves us guessing what kind of dynamic model lies behind all these correlations. Given a correct dataset that matches battery prices to finished product costs, not Ms. Guerin-Calvert's flawed dataset, the proper approach would be to estimate a dynamic model, as econometricians would, something that Ms. Guerin-Calvert did not do.

E. Ms. Guerin-Calvert's Claim of No Pass-Through Due to the Small Size of the Estimated Overcharges Relative to the Total Price of Class Products Is Unsupported and Incorrect

119. As I have explained above, the total cost is the sum of many cost components including battery cost. Although a change in battery costs may be "small" a small change in total costs is not identifying a change in battery costs. A small change in total costs occurs when the changes in components of total costs that are positive are offset by changes in components of total costs that are negative. In the but-for world in which battery prices were lower, the change in costs at every level is reduced somewhat but most of the total cost changes would remain "large" with this hypothetical difference. To study that hypothetical, we need to study small changes to large total cost changes, not small total cost changes. With that as the goal, I report how I studied the extent

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to which the effect of total cost changes in product prices depends on the size of the total cost change, small or large.

120. Ms Guerin-Calvert claims that "what [is] identified as 'small' cost changes [in Dr. Leamer's pass-through model] are in fact in the majority of instances larger than his estimated cell price overcharges… [T]he maximum overcharge applied across 8-cells is still smaller than 45% of all of the 'small' costs that Dr. Leamer has defined in his pass-through data."[39] She states that the estimates of the total costs of cells for a finished products are "within the same interval of statistically 'zero' cost change category that Dr. Leamer defines and therefore would involve no impact."[40]

121. In my threshold regression, I grouped monthly observations for each model number according to whether the cost change for that month was 1) 0% to 0.1% change from the previous month, 2) 0.1% to 5% change from the previous month, and 3) 5% change from the previous month. An alternative way to define the first two categories would be 0% and (0% to 5%). The results of the model do not in any way hinge on the choice between 0.1% or 0% lower bound.

122. Ms. Guerin-Calvert suggests that the records with "statistically zero" cost changes would not have been impacted by the conspiracy. This is not a feature of my model which has positive pass-through for every cost change except mathematical zeroes. Moreover, whether a particular price at a particular point in time is affected by the conspiracy depends on the whole previous history of price changes in the but-for world compared with the actual world. The current elevation of costs is the sum of the current cost increase and past cost increases due to the price elevation by the cartel.

123. Ms. Guerin-Calvert has taken an issue with my definition of the "small" cost changes in this model. The "small" cost threshold of 5% change was chosen to

[39] Guerin-Calvert Report, 39 (Exhibit 5).

[40] Guerin-Calvert Report, 40 (Exhibit 6).

test whether smaller cost changes are passed-on at a different rate compared to larger cost changes.

124. Ms. Guerin-Calvert suggests that the price changes within this category are generally higher than the typical overcharge estimated by my model. I address this concern by estimating an alternative model using a dollar threshold that is similar to the estimated overcharges. Ms. Guerin-Calvert estimated that an alleged overcharge on a median-cost Notebook with an 8-cell battery pack would be around $3.50.[41] In Figure 16 below, I re-estimate the model using as the threshold monthly cost changes between $0 and $3.50.[42] The results are essentially the same as before – pass-through of both the larger and smaller cost changes (with statistically significant difference between the two, neither in the short-run nor in the long-run.)[43]

125. In addition, to confirm that pass-through occurs for all sizes of cost changes, I present a more general model that tests whether the pass-through rates differ significantly for various levels of cost changes. I examine pass-through for following thresholds: ($0-$3], ($3-$5], ($5-$10], ($10-$15], ($15-$20], ($20-$25], and ($25+).[44] See Figure 17. Though disaggregation of the pass-through effects comes at a cost of precision, this analysis supports pass-through within each interval of price changes in both the long-run and the short-run. Overall, the results again support the notion that there isn't any noteworthy difference in pass-through rates at different levels of cost change. While some categories show somewhat different pass-through rates in the short-run, in the long-run the pass-through is close to 100% for all thresholds.

[41] Guerin-Calvert Report, 47.

[42] Alternatively, I can define this category as $0.05 - $3.5 to avoid the same issue mentioned above. As Guerin-Calvert Report Exhibit 6 shows, 94% of the price changes in the 'zero' category are within +/- $0.05. This has no material effect on my estimations.

[43] In the backup to this report, I have included the analysis using 5% threshold and updated third-party datasets. The results did not materially change and support the conclusions presented in my report.

[44] The parenthesis indicate an open end of an interval and the bracket indicates a closed end to the interval.

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Figure 16

Threshold Pass-Through Regression Analysis
Cost Change Threshold $3.5

Variable	Estimate	Clustered Std. Error	T-Value	P-Value	Pass-Through Estimate
(1)	(2)	(3)	(4)	(5)	(6)
Dependent Variable: Unit Price					
Unit Price(-1)	0.690 ***	0.069	10.049	0.000	
Long-Run					
Unit Cost(-1)	0.390 ***	0.047	8.230	0.000	1.257
Unit Cost(-1)*(Abs Change ($0 - $3.5])	0.001	0.003	0.339	0.737	1.260
Short-Run					
Unit Cost - Unit Cost(-1)	0.620 ***	0.189	3.287	0.002	0.620
Unit Cost - Unit Cost(-1)*(Abs Change ($0 - $3.5])	-0.098	0.531	-0.185	0.854	0.522
Abs Change ($0 - $3.5] Indicator	-4.405 **	1.808	-2.436	0.020	
Abs Change ($0) Indicator	-7.128 **	2.709	-2.632	0.012	
Constant	-31.432	51.680	-0.608	0.547	
Part Number Fixed Effects	YES				
Quantity Weights	YES				
R-square	0.994				
Number of Observations	410,356				
Number of Companies	31				
Number of Part Numbers	106,534				

*** Statistically Significant at 99%; ** Statistically Significant at 95%; Statistically Significant at 90%.

Notes:
(1) Clustered Robust Standard Errors computed at company-product category level (39 clusters).

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Figure 17

Threshold Pass-Through Regression Analysis
Multiple Cost Change Thresholds

Variable	Estimate		Clustered Std. Error	T-Value	P-Value	Pass-Through Estimate
(1)	(2)		(3)	(4)	(5)	(6)
Dependent Variable: Unit Price						
Unit Price(-1)	0.689	***	0.068	10.066	0.000	
Long-Run						
Unit Cost(-1)	0.391	***	0.047	8.347	0.000	1.257
Unit Cost(-1)*(Abs Change ($0 - $3])	0.005	*	0.003	1.724	0.093	1.274
Unit Cost(-1)*(Abs Change ($3 - $5])	0.012	***	0.004	2.949	0.005	1.294
Unit Cost(-1)*(Abs Change ($5 - $10])	0.003		0.004	0.811	0.422	1.266
Unit Cost(-1)*(Abs Change ($10 - $15])	0.007		0.005	1.466	0.151	1.278
Unit Cost(-1)*(Abs Change ($15 - $20])	0.018	***	0.006	2.836	0.007	1.314
Unit Cost(-1)*(Abs Change ($20 - $25])	0.016		0.011	1.402	0.169	1.308
Short-Run						
Unit Cost - Unit Cost(-1)	0.635	***	0.193	3.297	0.002	0.635
Unit Cost - Unit Cost(-1)*(Abs Change ($0 - $3])	-0.080		0.678	-0.117	0.907	0.555
Unit Cost - Unit Cost(-1)*(Abs Change ($3 - $5])	-0.218		0.418	-0.521	0.605	0.417
Unit Cost - Unit Cost(-1)*(Abs Change ($5 - $10])	-0.558	***	0.137	-4.079	0.000	0.077
Unit Cost - Unit Cost(-1)*(Abs Change ($10 - $15])	-0.175		0.223	-0.786	0.437	0.460
Unit Cost - Unit Cost(-1)*(Abs Change ($15 - $20])	-0.044		0.232	-0.189	0.851	0.591
Unit Cost - Unit Cost(-1)*(Abs Change ($20 - $25])	-0.144		0.132	-1.086	0.284	0.491
(Abs Change ($0 - $3])	-13.455	***	3.062	-4.394	0.000	
(Abs Change ($3 - $5])	-15.867	***	4.217	-3.762	0.001	
(Abs Change ($5 - $10])	-13.033	***	3.293	-3.957	0.000	
(Abs Change ($10 - $15])	-14.009	***	3.377	-4.149	0.000	
(Abs Change ($15 - $20])	-19.277	***	2.914	-6.616	0.000	
(Abs Change ($20 - $25])	-17.309	*	8.727	-1.983	0.055	
(Abs Change ($0)	-13.474	***	3.766	-3.577	0.001	
Constant	-25.729		51.699	-0.498	0.622	
Part Number Fixed Effects	YES					
Quantity Weights	YES					
R-square	0.994					
Number of Observations	410,356					
Number of Companies	31					
Number of Part Numbers	106,534					

*** Statistically Significant at 99%; ** Statistically Significant at 95%; Statistically Significant at 90%.

Notes:
(1) Clustered Robust Standard Errors computed at company-product category level (39 clusters).

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F. Ms. Guerin-Calvert's Claim that the Data Analyzed for Pass-Through Is Unrepresentative and that My Conclusions are Consequently Incomplete Is Unsupported and Incorrect

126. In my initial report I analyzed data from OEMs, distributors, and retailers that included sales to other businesses, government entities, and consumers.[45] After my initial report, I received data and information from additional third-party entities. These new datasets include such large retailers as Costco and Circuit City. I have updated my pass-through analyses with 14 additional third-party datasets and have also added analyses of pass-through by OEMs and retailers on replacement batteries. Figure 18 through Figure 21 below show updated long-run pass-through estimates with those additional analyses. These new analyses provide additional support for my original conclusion that the best estimate of the pass-through rate is 100%.[46]

[45] For example, the Dell sales data I analyzed included government entities.

[46] For those that place some particular importance on the statistical precision of these estimates, I would add that those with a confidence interval bounded above zero exceed "conventional" levels of statistical significance at the 95% level, while others, e.g., AOpen, still exceed the 90% level of statistical significance.

Figure 18

LIB Finished Product Pass-Through Estimates Summary
No Part Number Fixed Effects

		Notebook		Camcorder		Power Tools	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(9)	(10)
OEM	[redacted]	0.61	(-.01,1.24)				
OEM	Acer	1.21	(1.11,1.31)				
OEM	[redacted]					1.03	(.91,1.15)
OEM	Cornwell					1.02	(.98,1.07)
OEM	Dell	1.29	(1.26,1.32)				
OEM	Fujitsu	1.38	(1.33,1.43)				
OEM	HP	1.09	(.79,1.4)				
OEM	JVC			1.40	(1.36,1.44)		
OEM	Sony	1.04	(1.02,1.05)	1.18	(1.15,1.21)		
OEM	Toshiba	1.07	(1.06,1.08)				
Distributor	ASI	0.89	(.8,.98)				
Distributor	Ingram	1.02	(1.02,1.02)	1.03	(1.03,1.03)		
Distributor	SED	0.94	(.92,.96)				
Retailer	ACE Hardware					1.04	(.98,1.11)
Retailer	Amazon	1.71	(.66,2.76)				
Retailer	B&H			1.09	(1.07,1.12)		
Retailer	[redacted]	1.32	(1.32,1.33)	1.47	(1.46,1.49)		
Retailer	Brandsmart	1.01	(1,1.03)	1.06	(.93,1.18)		
Retailer	CDW	0.81	(.79,.84)				
Retailer	Circuit City	1.00	(.97,1.03)	0.49	(.31,.66)		
Retailer	CompUSA	0.98	(.95,1)				
Retailer	CompuCom	1.05	(1.04,1.06)				
Retailer	Costco	1.02	(1.01,1.04)				
Retailer	Crutchfield			1.17	(1.12,1.22)		
Retailer	Fry's					0.68	(.59,.78)
Retailer	Home Depot					1.04	(1.02,1.06)
Retailer	Insight	0.90	(.87,.92)				
Retailer	[redacted]	0.93	(.89,.97)	1.03	(.99,1.07)		
Retailer	Nebraska FM	1.03	(.95,1.11)				
Retailer	[redacted]	0.77	(.69,.85)	1.02	(1.01,1.02)		
Retailer	PC Connection	0.91	(.9,.92)	1.11	(1.1,1.11)		
Retailer	[redacted]	0.97	(.96,.97)	1.05	(1.05,1.06)		

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1).
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Long-Run Pass-Through estimates are presented.
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.

Figure 19

LIB Finished Product Pass-Through Estimates Summary
Part Number Fixed Effects

Level	Company	Notebook Estimate	Notebook 95% CI	Camcorder Estimate	Camcorder 95% CI	Power Tools Estimate	Power Tools 95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(9)
OEM	[redacted]	1.61	(1.11,2.12)				
OEM	Acer	1.26	(1.16,1.36)				
OEM	[redacted]					1.45	(.9,2)
OEM	Cornwell					1.11	(.96,1.25)
OEM	Dell	1.35	(1.27,1.44)				
OEM	Fujitsu	1.10	(1.03,1.17)				
OEM	HP	1.74	(.49,2.98)				
OEM	JVC			0.94	(.86,1.02)		
OEM	Sony	0.83	(.71,.94)	0.62	(.54,.71)		
OEM	Toshiba	0.82	(.8,.84)				
Distributor	ASI	0.70	(.53,.87)				
Distributor	Ingram	1.02	(1.01,1.02)	1.00	(.99,1.01)		
Distributor	SED	1.02	(.98,1.05)				
Retailer	ACE Hardware					0.35	(.29,.42)
Retailer	Amazon	0.75	(.34,1.16)				
Retailer	B&H			0.82	(.75,.9)		
Retailer	[redacted]	0.98	(.93,1.03)	1.81	(1.73,1.9)		
Retailer	Brandsmart	0.96	(.9,1.03)	1.69	(1.34,2.04)		
Retailer	CDW	0.75	(.73,.78)				
Retailer	Circuit City	1.76	(1.68,1.83)	3.62	(3.15,4.09)		
Retailer	CompUSA	3.04	(2.9,3.18)				
Retailer	CompuCom	0.97	(.95,.99)				
Retailer	Costco	1.20	(1.12,1.29)				
Retailer	Crutchfield			3.02	(2.51,3.52)		
Retailer	Fry's					0.94	(.61,1.26)
Retailer	Home Depot					0.42	(.3,.55)
Retailer	Insight	0.43	(.41,.46)				
Retailer	[redacted]	1.15	(1.12,1.19)	1.25	(1.16,1.34)		
Retailer	Nebraska FM	1.14	(.59,1.69)				
Retailer	[redacted]	0.95	(.9,1.01)	0.91	(.8,1.02)		
Retailer	PC Connection	0.96	(.96,.97)	1.17	(1.13,1.21)		
Retailer	[redacted]	0.71	(.7,.73)	1.06	(.98,1.13)		

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1), Part Number Fixed Effects.
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Long-Run Pass-Through estimates are presented.
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.

Figure 20: Replacement Batteries Also Show Pass-Through

LIB Replacement Battery Pass-Through Estimates Summary
No Part Number Fixed Effects

		Notebook		Camcorder		Power Tools	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OEM	Bizcom	0.67	(.58,.76)				
OEM	Cornwell					1.16	(1.13,1.19)
Retailer	CDW	0.98	(.95,1.02)	0.96	(.73,1.19)		
Retailer	Home Depot					0.62	(.1,1.14)

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1).
(2) Long-Run Pass-Through estimates are presented.
(3) Based on monthly average prices and costs by manufacturer part number or SKU.
(4) Quantity weighted regressions.
(5) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(6) Notebook regressions include an indicator for Netbooks where applicable.

Figure 21: Replacement Batteries Also Show Pass-Through

LIB Replacement Battery Pass-Through Estimates Summary
Part Number Fixed Effects

		Notebook		Camcorder		Power Tools	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OEM	Bizcom	0.76	(.68,.84)				
OEM	Cornwell					0.24	(0,.47)
Retailer	CDW	0.72	(.67,.77)	0.22	(-.86,1.3)		
Retailer	Home Depot					0.74	(.57,.91)

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1), Part Number Fixed Effects.
(2) Long-Run Pass-Through estimates are presented.
(3) Based on monthly average prices and costs by manufacturer part number or SKU.
(4) Quantity weighted regressions.
(5) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(6) Notebook regressions include an indicator for Netbooks where applicable.

127. Defendants in this case also take issue with the data selection, claiming that the data was "chosen at the discretion of biased third parties whom [I] did not supervise."[47] This is misleading and wrong. I instructed a consulting company to give me as much usable data as possible for my analysis. The consulting company prepared the data sets, which is customary for economists in my field. I ran the regressions and performed all substantive work.[48]

G. Ms. Guerin-Calvert's Claim that I Did Not Show Battery-Specific Pass-Through Is Unfounded

128. In my previous report, I presented a regression model that estimated the effect of the battery costs on notebook prices, controlling for other costs, using Toshiba notebook data.[49] This model provided evidence to support the hypothesis that changes in battery costs would be passed on one-to-one to the finished product price. Ms. Guerin-Calvert's only critique of this model was that the battery cost coefficient did not show "a statistically significant pass-through for battery costs at even 90% confidence level" or that "the variation in battery cost does not provide any statistically measurable effect on the product price."[50]

129. Ms. Guerin-Calvert has once again turned an estimate different from zero into a zero because she apparently thinks she can do this if the p-value is too high. With the limited data at hand, our best estimate is 0.88 which is statistically significant at 88% confidence level.[51] Earlier in this report, I described my strong disagreement to taking conventional levels of 90% as hard thresholds.

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[47] Defendants' Motion to Exclude the Proposed Expert Testimony of Dr. Edward E. Leamer, November 18, 2006 at 26:14.

[48] Some large retailers did not provide adequate data for conducting pass-through analysis. For example, Target provided only their purchase records and no sales records.

[49] Leamer Report, 75 (Figure 42).

[50] Guerin-Calvert Report, 56.

[51] Upon further examination, I have updated the dataset for this analysis by removing outliers on the transactional notebook prices below 1st percentile and above 99th percentile in each year. Prior to the removal of outliers the estimate was statistically significant at 85% confidence level. This does not result in material

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130. Moreover, Ms. Guerin-Calvert is testing the hypothesis that battery cost pass-through equals zero. In my earlier and current reports I discussed at length the economic theory that suggests that 100% pass-through of all components, including batteries, should be the starting presumption. Hence, a more appropriate hypothesis test would be whether battery cost pass-through is 100%, (i.e., that the Battery Cost coefficient equals 1). Another, more relevant, hypothesis would be whether the battery cost changes are passed on at the same rate as all other costs. I described these tests in my deposition testimony.[52] In Figure 22 below, I present the results of both of these hypotheses tests. The results support the hypothesis that battery costs are passed on at 100% and that the battery costs are passed on at the same rate as all other costs.

change to the estimates and my conclusions.

[52] Leamer Deposition, 61:18-62:16.

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Figure 22

Toshiba Notebook Battery Cost Pass-Through

Dependent Variable: Notebook Sales Price

Variable	Estimate	St. Error	T-Value	P-Value
(1)	(2)	(3)	(4)	(5)
Battery Cost	0.88	0.55	1.58	0.115
Other Costs	1.30 ***	0.02	79.27	0.000
Number of Cells				
6	-1.50	13.80	-0.11	0.914
8	-55.76	37.04	-1.51	0.134
9	-36.31	41.48	-0.88	0.383
12	-74.07	45.34	-1.63	0.104
Constant	-103.37 ***	17.84	-5.79	0.000
Quantity Weights	YES			
R-Square	0.98			
Observations	159			

Hypothesis Tests

Battery Cost = Other Costs: Fail To Reject (P-Value=0.45)
Battery Cost = 1: Fail To Reject (P-Value=0.82)

Notes: (1) Other Cost defined as COGS less battery cost.

*** Statistically Significant at 99% level.

Source: Toshiba notebook sales and cost data.

H. Ms. Guerin-Calvert's Claim that My Conclusions on Pass-Through are Insufficient Due to the Absence of Packer Data Are Invalid

1. The Absence of Data for the Mainly Non-U.S. Packers Does Not Change the Expectation of Pass-Through

131. Economic theory predicts that packers will pass-through LIB cell overcharges to customers of packs. The evidentiary record that I have reviewed is consistent with this theory. For instance, a Taiwanese newspaper article circulated between two LIB manufacturers, SDI and Panasonic, indicated that packers were increasing LIB pack prices in response to cell price increases by more than 100% of the increase.[53] LIB manufacturers also often colluded about packs at the same time and on the same terms that they colluded about cells.[54] When LIB manufacturers colluded about cell prices, this collusion was often targeted at customers of *packs* as well.[55] The only logical inference from this is that the conspirators believed that pass-through at the packer level--which they did not control--would be 100% or more. Otherwise they would have had to offer lower price increases to pack customers in order to remain competitive.

132. As I have described above and previously, a wise starting presumption based on economic theory and research is that pass-through is 100%. The absence of data for non-U.S. LIB cell packers does not in any way raise doubts about the presumption that pass-through by packers was positive and likely in the neighborhood of 100%.[56]

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[53] PANA-C000073662E ("Driven by the price adjustments of batt[er]y cell suppliers, large Taiwanese battery manufacturers have recently officially increased their product sales prices.").

[54] Deposition of Kazuhiro Nakae Volume I, June 21, 2016 at 42:17-43:2; Deposition of Kazuhiro Nakae Volume II, June 22, 2016 at 200:24-201:9, 228:17-25.

[55] PANA-C000173982E (Deposition Exhibit 2078E); Deposition of Kazuhiro Nakae Volume I, June 21, 2016 at 24:21-23 (Acer was a pack customer); Deposition of Kazuhiro Nakae Volume II, June 22, 2016 at 212:8-214:4 (Toshiba, ACER, ASUS, and ODM (original device manufacturers) were pack customers).

[56] See e.g., an email from a representative of Panasonic: "I heard from SDI guy that recently there was an article on the Taiwanese news paper on the price increase issue by Simplo. According to him, Sun san mentioned recent material cost increase caused pack price increase and from July onward further price

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2. Utilizing Recently Provided U.S. Packer Data Indicates Pass-Through

133. Since my initial report, I have been provided with data from a non-party battery packer, Palladium, with purchases of battery cells and sales of battery packs.[57] These data are for sales and purchases of prismatic lithium-ion batteries used in mobile phones and GPS devices. While prismatic batteries are not in the proposed class, the issues of the pass-through on battery packs are the same, i.e. 100% pass-through is expected.

134. Using data and documents provided, I was able to determine the exact cell type within each battery pack sold by Palladium for sufficient number of packs to conduct the analysis. With the limited data, it is not possible to analyze the inter-temporal effects within each battery pack. However, I can analyze the relationship between battery cell costs and battery pack prices from the variability of battery cell types (dimensions) included in different battery packs. This approach is consistent with the Toshiba notebook battery cost pass-through analysis in Figure 28 above (Figure 42 in my initial report).

135. Figure 23 below reports the results of a regression model of the relationship between LIB cell costs and LIB pack prices. Consistent with the expectation from theory the estimated pass-through of LIB costs into LIB pack prices is estimated to be close to 100%.

increase of their packs would be requested." PANA-C000073662E

[57] Palladium Energy, Inc., founded in 1973, designs, engineers and manufactures battery packs (including lithium-ion) and other power products for a variety of markets. In 2012, Palladium became the largest battery pack integrator in the Americas and Europe. (See "Company Overview of Palladium Energy, Inc.," Bloomberg, August 23, 2016, http://www.bloomberg.com/Research/stocks/private/snapshot.asp?privcapid=61574362 ; and "Palladium Energy," LinkedIn, https://www.linkedin.com/company/palladium-energy).

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Figure 23

Independent Packer Battery Cell Cost Pass-Through Palladium

Dependent Variable: Battery Pack Price[1]

Variable	Estimate	St. Error	T-Value	P-Value
(1)	(2)	(3)	(4)	(5)
Battery Cell Cost[2]	0.92 ***	0.07	13.58	0.000
Constant	2.10 ***	0.18	11.75	0.000
Quantity Weights	YES			
R-Square	0.88			
Observations	27			

Hypothesis Tests

Battery Cell Cost = 1: Fail To Reject (P-Value=0.28)

[1] Weighted average price of a battery pack by part number.

[2] Weighted average purchase cost of a battery cell in a battery pack.

*** Statistically Significant at 99% level.

Source: Palladium pack sales and cell purchase data.

I. Pass-Through Occurs in Both the Short and Long Run

136. In my report I presented the long-run pass-through rates of the total cost changes on finished product prices. Ms Guerin-Calvert argues that "contrary to Dr. Leamer's focus on long-run pass-through, determining injury to indirect purchasers requires an analysis of short-run pass-through. Even if an overcharge is eventually passed-through, indirect purchasers before the increase would not have been harmed, and those after the increase would have."[58]

[58] Guerin-Calvert Report, 50-51.

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137. Elsewhere in this report, I address how the overcharges are embedded in the introductory prices of the finished products. In particular, I describe how the cheaper battery cells, absent the alleged conspiracy, would result in improved quality at the same price, that is to say lower quality-adjusted prices of finished products.

138. With regards to my pass-through regression analyses that utilize the full range of prices and costs over time, it is important to note that these regression models are dynamic in nature, i.e. they estimate both short-run and long-run pass-through rates. From these regressions, we can compute the pass-through rates at each month after the initial cost changes. In general, we would expect the effect of cost changes on product price to be felt gradually, i.e. some effect would be seen in the immediate period gradually increasing over time. Below I report the pass-through estimates, derived from the same regressions, at the 1st and 6th months after the cost change. Figure 24 and Figure 25 shows the 1st month effect from regressions without fixed effects and including fixed effects. Figure 26 and Figure 27 shows the 6th month effect from the regressions without and with fixed effects.

139. Figure 24 results show that 20 out of 41 estimates are above 0.7.[59] All the short-run pass-through estimates are positive. Ms. Guerin-Calvert's concern, that there may be no pass-through in the short-run, conflicts with the data evidence summarized by my dynamic model.

140. Along these same lines of arguments, Ms. Guerin-Calvert attempts to "analyze whether there is a seasonality component to when prices or costs may change."[60] To do this she disaggregates my pass-through datasets for each firm and product and, using my pass-through models, performs 4 separate regressions for each sub-set of the data, one for each quarter of the year. She claims that "there does appear to be some cyclicality in certain data sets

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[59] As I have mentioned before, any measurement errors in the costs result in a downward bias of these estimates.

[60] Guerin-Calvert Report, 54.

suggesting that firms updated their standard costs on a discrete basis at particular points in a year and at different points for different firms."[61]

141. Ms. Guerin-Calvert does not elaborate where specifically she sees this cyclicality in the collection of the regressions she performed. From the results that she reported in Exhibit 36, one cannot see an apparent systematic cyclicality. It is important to note that I have performed 32 regressions without part number fixed effects and 32 regressions with part number fixed effects (total of 64 regressions) in my original pass-through tables.[62] By disaggregating the datasets for each quarter, she quadrupled the number of regressions performed. It is not surprising to see some variation in the pass-through estimates after the dataset is disaggregated and even a handful of negative estimates. What is striking is, however, is that the collection of her numerous disaggregated pass-through regressions actually show an overwhelming support for the hypothesis of 100% pass-through. For example, 191 out 232 of her regressions show a pass-through estimate of at least 0.8 and 162 show an estimate of 0.95 and above.[63] Hence, regardless of whether any cyclicality of cost adjustments are present (an assertion that Ms. Guerin-Calvert has not supported), the conclusion is still 100% pass-through, according to Ms. Guerin-Calvert's own estimates.

[61] Guerin-Calvert Report, 54. and Exhibit 36.

[62] Leamer Report, 72-73 (Figures 40-41).

[63] Guerin-Calvert Report, 153 (Exhibit 36).

Figure 24

LIB Finished Product Pass-Through Estimates Summary
Short-Run Effect - 1 Month
No Part Number Fixed Effects

		Notebook		Camcorder		Power Tool	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OEM	[redacted]	0.24	(-.08,.57)				
OEM	Acer	1.05	(.98,1.11)				
OEM	[redacted]					0.41	(.06,.76)
OEM	Cornwell					0.58	(.39,.78)
OEM	Dell	0.73	(.63,.84)				
OEM	Fujitsu	0.28	(.21,.35)				
OEM	HP	0.14	(-.28,.56)				
OEM	JVC			0.13	(.06,.2)		
OEM	Sony	0.20	(.19,.21)	0.15	(.12,.17)		
OEM	Toshiba	0.11	(.11,.12)				
Distributor	ASI	0.32	(.2,.44)				
Distributor	Ingram	1.01	(1.01,1.01)	1.01	(1,1.01)		
Distributor	SED	0.78	(.76,.8)				
Retailer	ACE Hardware					0.10	(.09,.12)
Retailer	Amazon	0.65	(.46,.83)				
Retailer	B&H			0.28	(.2,.35)		
Retailer	[redacted]	1.32	(1.32,1.33)	1.47	(1.46,1.49)		
Retailer	Brandsmart	0.95	(.92,.97)	0.93	(.86,1.01)		
Retailer	CDW	0.78	(.75,.8)				
Retailer	Circuit City	0.93	(.9,.96)	0.54	(.51,.57)		
Retailer	CompUSA	0.54	(.52,.56)				
Retailer	CompuCom	0.87	(.85,.88)				
Retailer	Costco	0.91	(.87,.95)				
Retailer	Crutchfield			1.02	(.87,1.18)		
Retailer	Fry's					0.48	(.44,.53)
Retailer	Home Depot					0.92	(.83,1.02)
Retailer	Insight	0.39	(.38,.4)				
Retailer	[redacted]	0.93	(.89,.97)	1.14	(1.08,1.21)		
Retailer	Nebraska FM	0.23	(.03,.42)				
Retailer	[redacted]	0.32	(.28,.35)	0.90	(.81,.99)		
Retailer	PC Connection	0.89	(.88,.89)	1.10	(1.08,1.13)		
Retailer	[redacted]	0.68	(.66,.7)	0.63	(.46,.8)		

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1).
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Short-Run (1st month) Pass-Through estimates are presented, i.e. coefficient on Unit Cost
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types
(e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.

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Figure 25

LIB Finished Product Pass-Through Estimates Summary
Short-Run Effect - 1 Month
Part Number Fixed Effects

Level	Company	Notebook Estimate	Notebook 95% CI	Camcorder Estimate	Camcorder 95% CI	Power Tool Estimate	Power Tool 95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OEM	[redacted]	0.32	(-.03,.68)				
OEM	Acer	1.17	(1.09,1.24)				
OEM	[redacted]					0.58	(.25,.92)
OEM	Cornwell					0.73	(.57,.89)
OEM	Dell	0.75	(.65,.86)				
OEM	Fujitsu	0.42	(.34,.5)				
OEM	HP	0.81	(-.1,1.71)				
OEM	JVC			0.32	(.25,.38)		
OEM	Sony	0.20	(.17,.22)	0.19	(.16,.21)		
OEM	Toshiba	0.21	(.2,.22)				
Distributor	ASI	0.41	(.28,.54)				
Distributor	Ingram	1.01	(1,1.01)	1.01	(1,1.02)		
Distributor	SED	0.88	(.85,.91)				
Retailer	ACE Hardware					0.10	(.09,.12)
Retailer	Amazon	0.67	(.45,.89)				
Retailer	B&H			0.29	(.22,.36)		
Retailer	[redacted]	0.98	(.93,1.03)	1.81	(1.73,1.9)		
Retailer	Brandsmart	0.93	(.89,.96)	0.98	(.88,1.08)		
Retailer	CDW	0.66	(.64,.68)				
Retailer	Circuit City	0.84	(.81,.88)	0.54	(.51,.58)		
Retailer	CompUSA	0.81	(.78,.83)				
Retailer	CompuCom	0.88	(.86,.89)				
Retailer	Costco	0.92	(.85,.98)				
Retailer	Crutchfield			0.97	(.8,1.13)		
Retailer	Fry's					0.46	(.41,.51)
Retailer	Home Depot					0.64	(.55,.73)
Retailer	Insight	0.36	(.34,.37)				
Retailer	[redacted]	1.07	(1.03,1.1)	1.15	(1.09,1.21)		
Retailer	Nebraska FM	0.40	(.06,.75)				
Retailer	[redacted]	0.55	(.51,.59)	0.92	(.82,1.03)		
Retailer	PC Connection	0.86	(.86,.87)	1.12	(1.08,1.15)		
Retailer	[redacted]	0.66	(.64,.68)	0.74	(.54,.94)		

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1), Part Number Fixed Effects.
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Short-Run (1st month) Pass-Through estimates are presented, i.e. coefficient on Unit Cost.
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.

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Figure 26

LIB Finished Product Pass-Through Estimates Summary
Short-Run Effect - 6 Month
No Part Number Fixed Effects

		Notebook		Camcorder		Power Tool	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OEM	[redacted]	0.35	(-.01,.72)				
OEM	Acer	1.19	(1.09,1.28)				
OEM	[redacted]					0.72	(.52,.93)
OEM	Cornwell					0.94	(.87,1.01)
OEM	Dell	1.23	(1.18,1.27)				
OEM	Fujitsu	0.84	(.79,.89)				
OEM	HP	0.84	(.51,1.18)				
OEM	JVC			0.92	(.85,.99)		
OEM	Sony	0.55	(.54,.57)	0.51	(.46,.56)		
OEM	Toshiba	0.53	(.52,.55)				
Distributor	ASI	0.61	(.5,.72)				
Distributor	Ingram	1.02	(1.02,1.02)	1.03	(1.03,1.03)		
Distributor	SED	0.87	(.85,.89)				
Retailer	ACE Hardware					0.61	(.55,.66)
Retailer	Amazon	0.48	(.22,.73)				
Retailer	B&H			0.66	(.57,.75)		
Retailer	[redacted]	1.32	(1.32,1.33)	1.47	(1.46,1.49)		
Retailer	Brandsmart	1.00	(.98,1.01)	1.00	(.9,1.1)		
Retailer	CDW	0.79	(.77,.81)				
Retailer	Circuit City	0.96	(.94,.99)	0.54	(.5,.57)		
Retailer	CompUSA	0.79	(.76,.81)				
Retailer	CompuCom	1.03	(1.02,1.04)				
Retailer	Costco	1.00	(.98,1.02)				
Retailer	Crutchfield			1.09	(1,1.18)		
Retailer	Fry's					0.55	(.49,.61)
Retailer	Home Depot					1.04	(1.02,1.06)
Retailer	Insight	0.62	(.6,.64)				
Retailer	[redacted]	0.93	(.9,.96)	1.05	(1.02,1.09)		
Retailer	Nebraska FM	0.71	(.57,.85)				
Retailer	[redacted]	0.50	(.42,.58)	1.01	(1,1.02)		
Retailer	PC Connection	0.90	(.9,.91)	1.11	(1.1,1.11)		
Retailer	[redacted]	0.87	(.85,.88)	1.05	(1.05,1.06)		

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1).
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Short-Run (6th month) Pass-Through estimates are presented.
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.

Figure 27

LIB Finished Product Pass-Through Estimates Summary
Short-Run Effect - 6 Month
Part Number Fixed Effects

		Notebook		Camcorder		Power Tool	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OEM	[redacted]	1.55	(1.07,2.03)				
OEM	Acer	1.26	(1.15,1.36)				
OEM	[redacted]					1.19	(.82,1.56)
OEM	Cornwell					1.11	(.96,1.25)
OEM	Dell	1.35	(1.26,1.43)				
OEM	Fujitsu	1.10	(1.03,1.17)				
OEM	HP	1.73	(.52,2.94)				
OEM	JVC			0.93	(.85,1.01)		
OEM	Sony	0.59	(.52,.67)	0.51	(.44,.57)		
OEM	Toshiba	0.79	(.77,.81)				
Distributor	ASI	0.70	(.53,.87)				
Distributor	Ingram	1.02	(1.01,1.02)	1.00	(.99,1.01)		
Distributor	SED	1.02	(.98,1.05)				
Retailer	ACE Hardware					0.33	(.27,.39)
Retailer	Amazon	0.74	(.38,1.1)				
Retailer	B&H			0.74	(.67,.81)		
Retailer	[redacted]	0.98	(.93,1.03)	1.81	(1.73,1.9)		
Retailer	Brandsmart	0.96	(.9,1.03)	1.53	(1.25,1.8)		
Retailer	CDW	0.75	(.73,.78)				
Retailer	Circuit City	1.55	(1.49,1.61)	1.27	(1.17,1.36)		
Retailer	CompUSA	2.30	(2.23,2.37)				
Retailer	CompuCom	0.97	(.95,.99)				
Retailer	Costco	1.20	(1.12,1.29)				
Retailer	Crutchfield			2.42	(2.15,2.69)		
Retailer	Fry's					0.72	(.53,.91)
Retailer	Home Depot					0.43	(.3,.55)
Retailer	Insight	0.43	(.41,.46)				
Retailer	[redacted]	1.15	(1.12,1.19)	1.24	(1.16,1.33)		
Retailer	Nebraska FM	1.14	(.59,1.69)				
Retailer	[redacted]	0.94	(.89,1)	0.91	(.8,1.02)		
Retailer	PC Connection	0.96	(.96,.97)	1.17	(1.13,1.21)		
Retailer	[redacted]	0.71	(.7,.73)	1.06	(.98,1.13)		

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1), Part Number Fixed Effects.
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Short-Run (6th month) Pass-Through estimates are presented.
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.

V. Class Members Can Be Identified with a High Degree of Certainty

142. Counsel has asked me to review product information, defendant data, documents and industry data to see if they provide any information useful in the identification of class products, namely those finished products that included LIB cylindrical batteries produced by the defendants and sold during the class period. Here I summarize what I have learned from defendant documents and industry data in this regard and also report my findings from a review of products in the third party data and those purchased by class representatives.

143. Defendant and industry documents indicate that there are several feasible ways of determining which manufacturer's cells were incorporated in the battery pack of a notebook, camcorder, or power tool that do not involve having to break open a battery pack and physically inspect the cells.

144. First, produced documents reveal that, often in conjunction with OEM manufacturers, Defendants implemented protocols for marking the outside of battery packs that could be used to trace the origins of the pack. For example, an LG-Chem document describes how an 'HP Part Number' can be decoded to read off the name of the company that made the cells for the packs and in many instances, the vendors part numbers also indicate whether those cells are cylindrical.[64]

145. Second, the finished product manufacturers are a good source of information regarding the vendors of the battery packs used in their products. For example, Dell provides a service tag look-up on its website that can be used to retrieve information about the laptop specifications including the name of the pack

[64] LGC-MDL0138013 at Tab "Dec Shipment."

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maker and that can also be useful in determining the cell manufacturers.[65] Indeed, this type of ability has been put to use for battery recalls[66]

146. Third, as I explain below, industry data demonstrates that the Defendants held an overwhelming market share for cylindrical cells during the class period and more importantly that industry participants and Defendants themselves were well aware of the brands and the product lines that utilized non-Defendant and non-cylindrical cells. Indeed, Defendants kept very close track of who was supplying whom and the various supply relationships were well known. This is important because it implies that there are often easy ways of removing from the class certain products that are well-known not to contain Defendants' cylindrical cells. It also means that there is a rather narrow set of brand names and product lines that could potentially have non-class cells and those can be investigated by IIPs in advance.

147. Finally, very often, the Defendants' transactional data, sales summaries and product specification documents provide ways of tracing both the shape and the cell maker. I demonstrate some examples of this below in my examination of certain products purchased by class representatives.

A. Vast Majority of Cylindrical LIB Cells Were Manufactured by Defendants

148. Widely accepted data on the LIB industry makes it clear that any cylindrical lithium-ion battery almost certainly contained Defendant cells. As depicted in Figure 28 below, Defendants' combined market share of cylindrical cell sales during the class period was 93% and their average quarterly market share was 95%.[67] This indicates that non-defendants served a very small portion of the market. Moreover, documents indicate that industry participants were well-

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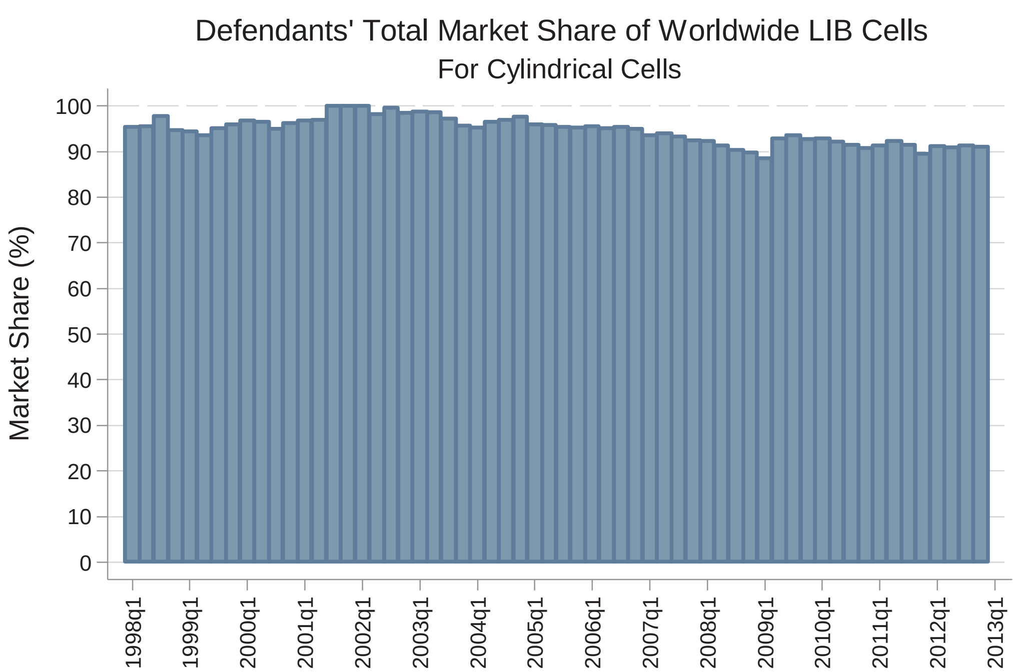
[65] Dell Laptop buyers can enter the Dell Service Tag number into a field on Dell's webpage (http://www.dell.com/support/home/us/en/4) to identify the battery pack manufacturer.

[66] For example, communications regarding Sony's recall of battery packs used in Dell laptops involved references to lot numbers as a way of keeping track of which cells were effected, see SANYO-C000468113.

[67] This is an updated version of Figure 17 in my original report. Since the source data did not identify Toshiba separately, I have included Toshiba in this chart by utilizing Toshiba's transactional sales data.

aware of the finished products manufacturers that sourced their cells from non-defendants. The vast majority of cells used during the class period for relevant products were produced by the Defendants and particular finished products that used non-defendant cells more heavily than the rest can be readily identified and studied by IPPs before hand for examining their potential removal from the class.

Figure 28



Note:Panasonic acquired Sanyo in December 2009.
Source: IIT LISHIP 2011 Data (SONY-LIB-000893992.xls), LGC-MDL0239585 and Defendant Sales Data.

149. The charts below use industry data to summarize the use of Defendant vs. non-Defendant lithium-ion cells by various brand names.[68] This data can be very informative in identifying OEMs that purchased cylindrical LIB primarily or exclusively from Defendants.

[68] Source data contains all three types of lithium-ion cells. Further discussion of usage of different types of cells follows below.

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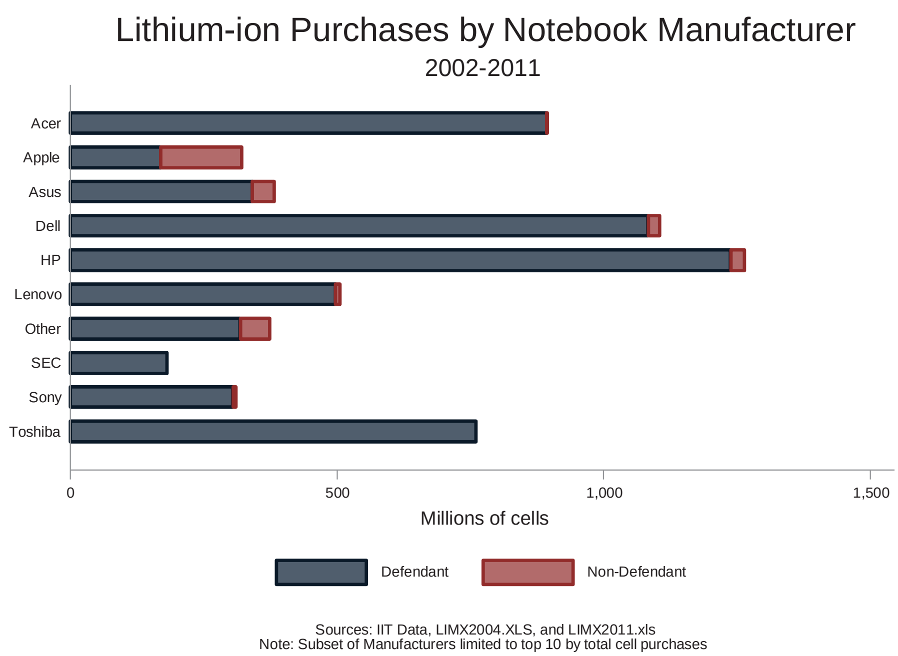
150. For example, it can be seen from Figure 29 that some of the most popular laptop brands (HP, Dell, Acer, Toshiba and Lenovo) bought almost exclusively from Defendants. Industry data summarized in Figure 30 suggests that the four largest camcorder manufacturers, Sony, Panasonic, JVC and Canon bought exclusively from Defendants.[69] Among power tools brands, Makita and Bosch also bought exclusively from Defendants as can be seen from Figure 31. With this information at hand, the enquiry into where might have non-Defendant batteries been used becomes a much more manageable undertaking than Defendants make it out to be.

Figure 29



[69] For instance, estimates suggest that the collective market share of just these four brands, Sony, Panasonic, JVC and Canon, in the US camcorder market in early 2007 was over 85%.

Figure 30

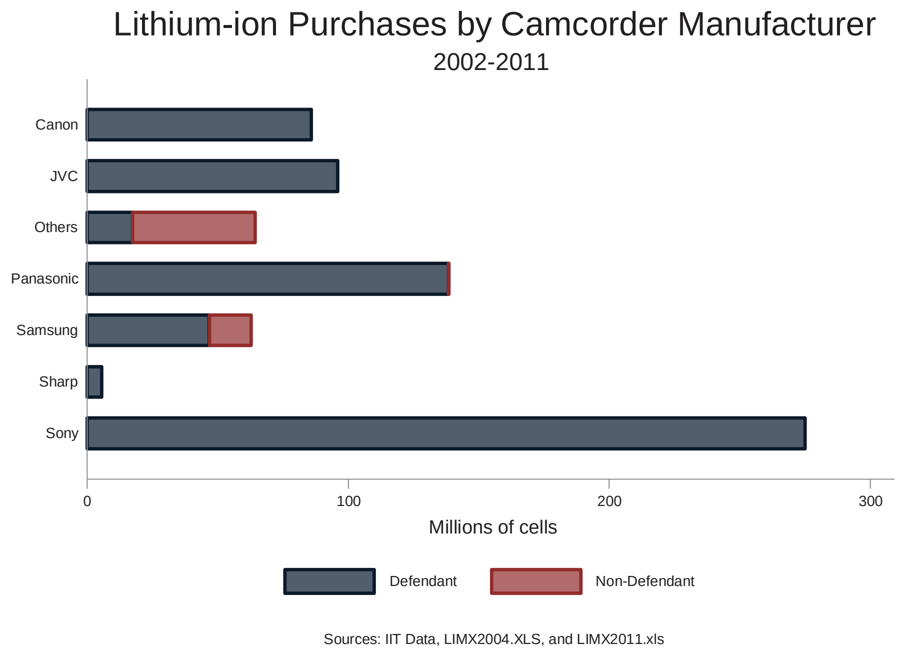
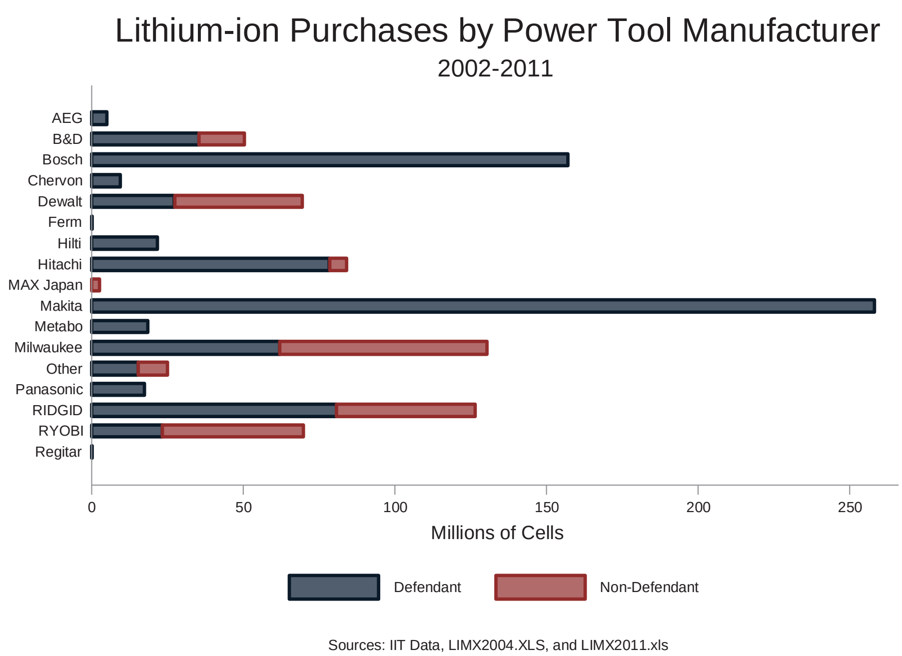


Figure 31



151. Defendant documents indicate that they targeted the U.S. market for sales of cylindrical LIB.[70] The non-Defendant LIB manufacturers were known for lower quality and lower prices that led to use of their products in markets such as China where lower quality finished products were produced and sold.[71]

B. Battery Manufacturer and Type Can Be Identified From Documents and Data

152. Defendant documents indicate that they kept very close track of not just the type of batteries their customers were using but also who supplied them. For example, a Sanyo document[72] which appears to be a compendium of over a hundred Dell battery pack projects. It records exactly what battery was used in them and who supplied it. Similarly, a Sony document[73] shows a detailed status report on several of Sony's customers with their battery purchases and vendor names. For instance, referring to this document it can be learned that the Lenovo Ultra portable X100e (MK-note) used cylindrical 18650 cells supplied by Sony (20%), Sanyo (40%) and Panasonic (40%).

153. Moreover, the defendants' data provides a vast amount of information regarding the various types of batteries used in notebooks, camcorders and

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[70] See, e.g., SNA0001596FT; SANYO0239834E; LGC-MDL0174346FT; LGC- MDL0006178_PT; LGC-MDL0100798E; LGC-MDL0068939; NECT000070938FT; PNA0213381FT at 413, 426.

[71] See for example Deposition of Micro Electronics, Inc. Through Its 30(B)6 Witness Kevin Hollingshead at 66:25-69:11 (U.S. OEM testifying that the use of Chinese suppliers' cells in its house brand computers would have been "contrary to our instructions"); Deposition of James L. Kaschmitter, May 11, 2016 at 87:11-14 ("The – one of the problems with Chinese new manufacturers was that quality was – was poor. This is why hoverboards explode all the time."); Deposition of Yong Ook (Andrew) Chung aka Yong Wook Chung, December 9, 2015 at 89:19-21 ("my understanding is that [Chinese manufacturer] BYD never did cylindrical type well. Therefore, I do not think that company would have been a threat."); Deposition of Yo Ahn "John" Oh, Volume I, June 28, 2016 at 41:6-8 ("There are many no named [Chinese LIB manufacturers] – homemade batteries, like homemade batteries, made the kind of failure.");SDI-B-000005140E at 5150E ("Chinese manufactures entry to Cylindrical is difficult at this time [August 2006] because of the safety issue"); LGC-MDL0071165 at 1165.23E (SDI states that Chinese manufacturer BYD is "[t]rying to enter the market for note PC but having difficulty due to quality issues").

[72] SANYO0432726. See also PANA-C000038788E which details various laptop manufacturer's particular laptop series supplied by Panasonic.

[73] SONY-LIB-001057495.

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power tools. For example, in several Defendants' transaction data, pack product codes come with an abbreviation of the customer name, so even when the first sales record appears to go an internal entity or a packer, the end-users name is clear. Examples are pack names such as '4UR18650F-DLL-13' for Dell as seen in Sanyo data[74] and pack names such as NP-F330, a battery pack commonly used in Sony camcorders, that shows up readily in Sony's sales data with Sony's cylindrical cells in it.[75] Defense expert Dr. Horn apparently did not consult Defendants' data when making his inquiries into battery type.[76] He may have found his inquires into class product determination far easier had he done so.

1. Notebooks

154. Notebooks primarily used lithium-ion cylindrical batteries, and almost exclusively early in the class period. Late in the class period thinner laptops emerged that used lithium-polymer or prismatic batteries. As I describe below, the particular brands that used non-cylindrical batteries can generally be easily identified. Even before the start of the class period, adoption of lithium-ion technology in notebooks made use of Ni-Mh or Ni-Cd cells very uncommon and in lithium-ion, cylindrical cells have remained dominant.[77]

155. Among notebook manufacturers, Apple is the only one that made a complete shift to using polymer cells around 2006-2007. All other brands used cylindrical cells in their notebooks almost exclusively and they only have a few laptop series that are light-weight and slim and easily verified to have polymer batteries and hence can be excluded from the class.

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[74] SANYO0000241.

[75] This battery pack shows up in Sony data such as in SONY_LIB_DATA_0006.

[76] Deposition of Quinn Horn, Ph.D., P.E., July 22, 2016 at 190:9-191:7.

[77] LGC-MDL1593582 at p. 8

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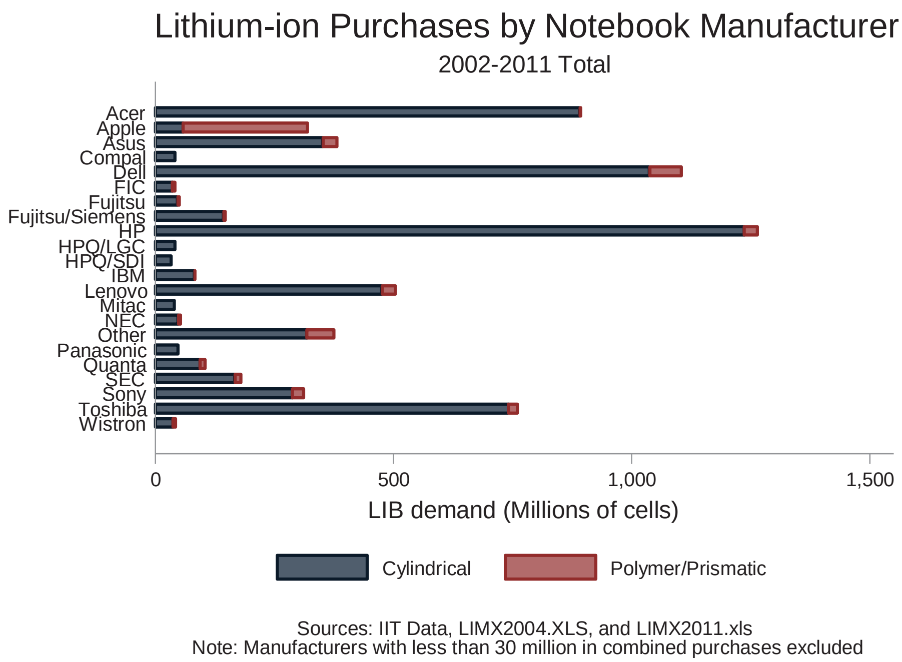
Figure 32



156. For instance, the Acer 'Aspire Timeline Ultra M3' laptops, Dell XPS 13 laptops and Toshiba Protégé R700 are known to have polymer batteries.[78] Indeed, market research firms regularly kept track of the offerings of laptops on the market and what types of batteries they utilize. Often, this sort of information is readily available from manufacturer product specifications and if it's not clear from the product manual, market research firms that Defendants utilized definitely kept track of this.[79]

2. Camcorders

157. During the class period, camcorders utilized Ni-Cd / Ni-Mh and both cylindrical and prismatic batteries.[80] Accordingly, I first looked to so see if product information can help distinguish camcorders that use lithium-ion and

[78] "Lithium Ion Batteries: A Japanese Tech Growth Story?," *Citi Research*, July 20, 2012.

[79] Eg, see Techno Research System's Notebook Product List in SONY-LIB-000818573

[80] For example, JVC's camcorder model GRAXM17US was supplied with a Ni-Mh battery pack with a model number BN-V10U. See http://resources.jvc.com/Resources/00/00/94/LYT1377-001B.pdf.

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next, whether there is any information to be found on which type of lithium-ion was used.

158. As a demonstrative exercise, my staff researched over 190 distinct camcorder model codes that represent about $11 billion in sales with the objective of finding whether or not they used lithium-ion batteries.[81] These include the top 150 products in the third-party data we received as well as models similar to them for which the same specifications apply. This set includes Sony, JVC, Panasonic and Canon camcorders. For the vast majority of the products list they started with, they could easily determine whether or not these products used lithium-ion batteries. So information about lithium-ion use appears to be very easily accessible. Further, they collected information regarding the battery packs used in these camcorders as indicated in user manuals etc. and were able to locate this information for nearly all of them.[82] For camcorders representing over $9b in sales, battery packs could be traced in Defendant data or documents to determine whether or not they used cylindrical cells.

159. Consequently, determining whether or not a camcorder uses lithium-ion batteries is generally just a matter of looking up the camcorder's product manual or product information online and its very clearly indicated.

160. A pattern that emerged from the study of these models is that camcorder manufacturers tend to use the same battery packs in many different camcorders. For instance, in my staff's research the three most frequently used based battery packs[83] alone account for about 40% of sales and are known to have used cylindrical batteries. This implies that the number of distinct battery

[81] To put this in perspective, the U.S. camcorder market was estimated to be worth about $1.7 billion in 2005. See "Sales of camcorders in the United States from 2005 to 2010," Statista http://www.statista.com/statistics/191932/sales-of-camcorders-in-the-us-since-2005/

[82] See e.g., "Your camcorder operates only with the 'InfoLITHIUM' battery pack... The "InfoLITHIUM" battery pack is a lithium-ion battery pack," from "Digital Video Camera Recorder: Operating Instructions and Owner's Record," Sony Corporation (2003), 200. See also the table "SPECIFICATIONS," from "Model DV14DCL, DV18DCL, DV14DVC, DV18DVC: Safety Instructions and Instruction Manual", Hitachi-Koki,10.

[83] The top three battery pack models in this set of products are NP-FM30, NP-F330 and NP-FM50.

packs that need to be investigated further to distinguish cylindrical from prismatic is not so great.

161. Industry data indicates that Sony almost exclusively used cylindrical battery packs. Sony is one of the largest camcorders brands in the US camcorder market, with market share climbing close to 50% in certain times during the class period.[84] JVC, Panasonic and Canon used both cylindrical and prismatic batteries, but they also used a small set of battery packs in many different camcorders which can be looked up in defendant data and documents to identify the cylindrical ones. For example, the JVC battery pack BN-VF808U can be found in Sanyo data.[85]

162. This exercise serves as an example of what can be learned about the use of cylindrical LIB in these products with documents and data alone. A lot more can be done if one were to make use of documents that contain cell tracing information for battery packs.

[84] PNA0072082 at Tab "Unit"

[85] See SANYO0000215

Table 1 – Camcorder Battery Type Identification

Model	Sales	Brand	Lithium-Ion Use	Battery Model	Cylindrical Cell	Cell Manufacturer
	(Million USD)					
(1)	(2)	(3)	(4)	(5)	(6)	(7)
ZR45MC	$ 45.06	Canon	Y	BP-508	Y	Sony
ZR70MC	38.23	Canon	Y	BP-512	Y	LGC
ZR65MC	36.44	Canon	Y	BP-508	Y	Sony
9382A001-(ZR85)	35.57	Canon	Y	BP-508	Y	Sony
9383A001-(ZR80)	28.44	Canon	Y	BP-508	Y	Sony
GZMG130US	104.89	JVC	Y	BN-VF808U	Y	Sanyo
GRD270US	81.78	JVC	Y	BN-VF707U		
GRSXM260US	78.48	JVC	N	BN-V11U		
GZMG21US	76.84	JVC	Y	BN-VF707U		
GRD30US	71.08	JVC	Y	BN-V408U	Y	Panasonic
SDR-H40	34.70	Panasonic	Y	VW-VBG070A	Y	Sanyo
PV-GS31	24.29	Panasonic	Y	CGR-DU06	Y	Panasonic
SDR-H80K	23.81	Panasonic	Y	VW-VBG070	Y	Sanyo/Panasonic
PVL780	21.04	Panasonic	N	PV-BP18		
PV-GS150	20.98	Panasonic	Y	CGA-DU12	N	Panasonic
CCDTRV68	184.74	Sony	Y	NP-F330	Y	Sony
DCRDVD108	178.82	Sony	Y	NP-FH40	Y	Sony
DCRDVD92	172.18	Sony	Y	NP-FP50	Y	Sony
DCRDVD105	146.33	Sony	Y	NP-FP50	Y	Sony
CCDTRV37	143.88	Sony	Y	NP-F330	Y	Sony

Source: Product Manuals and Retailer Webpages, Defendants' Documents and Data.

3. *Power Tools*

163. During the Class Period battery-operated power pools either used cylindrical LIB or Ni-Cd batteries. Since they did not use other types of lithium-ion, simply knowing if they had lithium-ion batteries is sufficient to determine the battery to be cylindrical. Whether a power tool has a lithium-ion or a Ni-Cd battery can be easily verified from the product's description or specifications. My staff researched 100 products representing about $1.5 billion in sales to investigate if it's possible to determine whether these use lithium-ion batteries or not. Often times the only identifier in the data for these products is a Best Buy internal SKU number or a product description and they did not even have a model code for the product to go by.

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164. Out of 100 products reviewed, my staff was able to find information about whether or not they used lithium-ion batteries in 81 cases. In many cases there is a direct indication in the product description about lithium-ion use. Table 2 presents a subset of these products researched and the remaining are provided in the backup materials to this Report.

165. My staff also reviewed all of the products in the Hitachi-Koki data and were able to find not just the type of battery used in them but also the model number of the battery pack. Table 3 presents the Hitachi-Koki products researched. This battery model number can further be used to research which cell manufacturers may have supplied the cells used in these batteries. For example, BCL1015 is one of the most used battery pack in these models for which is known to have contained Hitachi Maxell's 18650PA cells.[86]

[86] IIT LIB-related Study Program 08-09 (September 2008), p 50

Table 2 – Power Tools Battery Type Identification

SKU/Model Number	Power Tool Manufacturer	Description	LIB
(1)	(2)	(3)	(4)
847357	Makita	MAKITA 18V LI-ION DVR DRLL/IMPCT KIT	Y
200706	Ryobi	RYOBI 18V SUPER COMBO KIT	N
847554	Makita	MAKITA 18V LI-ION HMMR/IMPCT KIT	Y
338116	Ryobi	RYOBI 1/2" 18V CORDLESS DRILL KIT	N
339208	Ryobi	RYOBI 18V ONE+ STARTER COMBO KIT	N
336235	Ryobi	RYOBI ONE+ 18V BATTERY 2 PK	--
DCK265L	Dewalt	18V CPT Li-Ion DRILL /IMPACT COMBO KIT	Y
836083	Milwaukee	MILWAUKEE 1/2" 18V COMPACT DRILL	Y
DCD970KL		18V XRP 1/2" HAMMER DRILL/DRIVER KIT	Y
DCD760KL	Dewalt	18V COMPACT Li-Ion DRILL / DRIVER	Y
XFD01CW	Makita	MAKITA 1/2" 18V DRIVER/DRILL KIT	Y
743076	Ryobi	RYOBI 1/2" 18V COMPACT DRILL KIT	Y
607557	Makita	MAKITA 18V LI-ION 4PC COMBO KIT	Y
DCX6401	Dewalt	36V CORDLESS 4-TOOL COMBO KIT	Y
607695	Ryobi	RYOBI 18V LI-ION COMPACT BATTERY 2PK	Y
2602-22	Milwaukee	M18 CORDLESS HAMMERDRILL	Y
836027	Ridgid	RIDGID 5PC LITHIUM ION COMBO KIT	Y
DC927KL	Dewalt	HEAVY DUTY 18V CORDLESS HAMMERDRILL	Y
722674	Ryobi	RYOBI 3/8"12V LI-ION CRDLSS DRILL	Y
895410	Ryobi	RYOBI 18V LI-ION CMPCT COMBO KIT	Y
906747	Rigid	RIDGID 18V LITHIUM COMPACT DRILL/DRI	Y
830719	Ridgid	RIDGID 12V LI-ION MULTI-TOOL KIT	Y
755104	Ryobi	RYOBI 1/4" 18V IMPACT DRIVER KIT	--
319849	Milwaukee	MILWAUKEE 3/8" 12V CORDLESS DRILL	--
724847	Ryobi	RYOBI 18V LI-ION SINGLE BATTERY PK	Y
340364	Ryobi	RYOBI 3/8" 12V CORDLESS DRILL/DRIVER	N
738840	Rigid	RIGID 18V LI-ION 5PC CORDLESS KIT	Y
DCK211S2	Dewalt	12V MAX Li-LON DRILL / IMPACT COMBO KIT	Y
453040	Milwaukee	MILWAUKEE M18 4PK COMBO KIT	Y
802504	Ryobi	RYOBI 1/4" 4V CORDLESS SCREWDRIVER	--
916062	Ryobi	RYOBI AUTOSHIFT COMBO	Y
175795	Milwaukee	M18 HMR DRILL/IMP/SAWZALL/LIGHT	Y
339438	Ryobi	RYOBI ONE+ 18V BATTERY PACK	N
2401-22	Milwaukee	MILWAUKEE 1/4" 12V CRDLSS SCRWDRVR	Y
637212		10.8V LITHIUM ION CDLS COMBO KIT	Y
DC900KL	Dewalt	36V CORDLESS HAMMERDRILL KIT	Y
933227	Makita	MAKITA 1/4" 18V IMPACT DRIVER	Y
756950	Ryobi	RYOBI 3/8" 9.6V CORDLESS DRILL	N
721788	Rigid	RIDGID 12V 2 SPEED DRILL W/ LIGHT	--
876984	Ryobi	RYOBI 4V LI-ION SCREWDRIVER	Y
607632	Makita	MAKITA 1/2" 18V HAMMER DRILL	--
737681	Rigid	RIDGID 18V 3AH LI-ION BATTERY	Y
799291	Rigid	RIDGID 1/2" 18V CRDLSS DRILL KIT	Y
607658	Makita	LXT 18V IMPACT DRIVER	Y
DCD710S2	Dewalt	12V MAX LITHIUM ION DRILL / DRIVER	Y
658560	Rigid	RIDGID 18V 4PC LITHIUM COMPACT COMBO	Y
731738		18V LITHIUM HAMMER DRILL	Y
175608	Milwaukee	M12 DRILL DRIVER/IMPACT COMBO KIT	Y
324434	Milwaukee	MILW 1/4" 18V HEX IMPACT DRVR WRENCH	Y
607887	Makita	MAKITA 18V LXT SINGLE PACK BATTERY	Y

Sources: Product Manual and Retailer Webpages

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Table 3 – Batteries used in Hitachi-Koki Power Tools

Model Code	Product Type	Description	Lithium-Ion Use	Battery Model
(1)	(2)	(3)	(4)	(5)
C18DL	CIRCULER SAW	2 of EBM1830 Li-Ion BAT 3.0 Ah	Y	BCL1840
KC10DAL	COMBO KIT	10.8V DB10DL WH10DL 3PS COMBO	Y	BCL1015
KC10DALPL	COMBO KIT	10.8V DB10DL WH10DL 2PS COMBO	Y	BCL1015
KC10DBL	COMBO KIT	10.8V DB10DL CR10DL 3PCS COMBO	Y	BCL1015
KC10DBLPL	COMBO KIT	10.8V DB10DL CR10DL 2PCS COMBO	Y	BCL1015
KC10DFL	COMBO KIT	12V PEAK DS10DFL WH10DFL COMBO	Y	BCL1015
KC10DGL	COMBO KIT	10.8V DS10DFL CR10DL 2PSCOMBO	Y	BCL1015
KC18DAL	COMBO KIT	DISCO NO REPLACEMENT	Y	EBM1830
KC18DBL	COMBO KIT	KIT DV18DL CR18DL C18DL UB18DL	Y	EBM1830
KC18DBLS	COMBO KIT	18V 3-PC CORDLESS COMBO KIT	Y	BCL1840
KC18DCL	COMBO KIT	DV18DL WH18DL UC18YRL EBM1830	Y	EBM1830
KC18DDL	COMBO KIT	18V 2-PC CORDLESS COMBO KIT	Y	BSL1850
KC18DFL	COMBO KIT	18V 2-PC CORDLESS COMBO KIT	Y	BCL1815
KC18DHL	COMBO KIT	18V 2-PC CORDLESS COMBO KIT	Y	BSL1830
DS10DFL	DRIVER DRILL	10.8V 3/8"CORDLESS DRIVER DRLL	Y	BCL1015
DS14DFL	DRIVER DRILL	14.4V 3/8"CORDLESS DRIVER DRIL	Y	BCL1415
DS14DFLPC	DRIVER DRILL	14.4V 3/8"CORDLESS DRIVER DRIL	Y	BCL1415
DS14DL	DRIVER DRILL	14.4V 1/2"CORDLESS DRIVER DRIL	Y	BCL1430
DS14DSFL	DRIVER DRILL	DISCO NO REPLACEMENT	Y	BSL1415
DS14DSL	DRIVER DRILL	DISCO NO RELPACEMENT	Y	BSL1430
DS18DBL	DRIVER DRILL	18V 1/2"CORDLESS DRIVER DRILL	Y	BSL1840
DS18DFL	DRIVER DRILL	18V 1/2"CORDLESS DRIVER DRILL	Y	BCL1815
DS18DFLPC	DRIVER DRILL	18V 1/2"CORDLESS DRIVER DRILL	Y	
DS18DFLS	DRIVER DRILL	400 IN/LBS BCL1815Li-Ion1.5Ah	Y	BCL1815
DS18DL	DRIVER DRILL	18V 1/2"CORDLESS DRIVER DRILL	Y	EBM1830
DS18DLPR	DRIVER DRILL	DEPLETE THEN USE DS18DSDL	Y	
DS18DSAL	DRIVER DRILL	18V 1/2"CORDLESS DRIVER DRILL	Y	BSL1430
G18DL	GRINDER	4.5"18V CORDLESS DISC GRINDER	Y	EBM1830
DV14DL	HAMMER DRILL	14.4V 1/2"CORDLESS HAMMER DRIL	Y	EBL1430
DV18DCL	HAMMER DRILL	18V 1/2"CORDLESS HAMMER DRILL	Y	EBM1830
DV18DL	HAMMER DRILL	18V 1/2"CORDLESS HAMMER DRILL	Y	EBM1830
DV18DSFL	HAMMER DRILL	18V 1/2"CORDLESS HAMMER DRILL	Y	BSL1815
DV18DSL	HAMMER DRILL	400 IN/LBS 2 of BSL1830 3.0Ah	Y	BSL1830
WH10DCL	IMPACT DRIVER	10.8V1/4"CORDLESS ANG IMP DRIV	Y	BCL1015
WH10DFL	IMPACT DRIVER	10.8V1/4"CORDLESS IMPACTDRIVER	Y	BCL1015
WH10DL	IMPACT DRIVER	10.8V1/4"CORDLESS IMPACTDRIVER	Y	BCL1015
WH14DBL	IMPACT DRIVER	14V1/4"CORDLESS IMPACT DRIVER	Y	BSL1430
WH14DL	IMPACT DRIVER	14V1/4"CORDLESS IMPACT DRIVER	Y	EBL1430
WH18DFL	IMPACT DRIVER	18V1/4"CORDLESS IMPACT DRIVER	Y	BCL1815
WH18DL	IMPACT DRIVER	1330"/# 0-3,200Ipm 3Ah EBM1830	Y	EBM1830
WH18DSAL	IMPACT DRIVER	18V1/4"CORDLESS IMPACT DRIVER	Y	BSL1815
WR14DL	IMPACT WRENCH	14V1/2"CORDLESS IMPACT WRENCH	Y	EBL1430
WR18DL	IMPACT WRENCH	18V1/2"CORDLESS IMPACT WRENCH	Y	EBM1830
CJ18DL	JIG SAW	18V CORDLESS JIG SAW D-HANDLE	Y	BCL1840
CR10DL	RECIP SAW	10.8V CORDLESS RECIP SAW	Y	BCL1015
CR18DL	RECIP SAW	3.0Ah Li-Ion BATTERY EBM1830	Y	BCL1840
DH18DL	ROTARY HAMMER	18V SDS+CORDLESS ROTARY HAMMER	Y	EBM1830
DH25DAL	ROTARY HAMMER	DISCO NOREPLACEMENT	Y	BSL2530
DB10DL	SCREW DRIVER	10.8V1/4"CORDLESS DRIVER DRILL	Y	BCL1015
DB3DL	SCREW DRIVER	3.6V1/4"CORDLESS SCREW DRIVER	Y	EBM315
DB3DL2	SCREW DRIVER	3.6V1/4"CORDLESS SCREW DRIVER	Y	EBM315

Sources: Product Manual and Retailer Webpages

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166. Contrary to what Ms. Gurein-Calvert suggests,[87] the switch away from Ni-Cd batteries was swift and complete for several power tool manufacturers. For instance Hitachi-Koki and Makita's decision around 2004-2005 was described as "[] not thinking of compatibility with NiCd and NiMH. They take the view that revising the design of the tool as a whole, starting from the assumption of using LIB packs, allows them to create more appealing products." Further that, "Milwaukee have also noticed this point, and they have abandoned their V18 series of LIB packs that can also be used on existing NiCd models, and completely updated their lineup with the LIB-only M18 series."[88]

167. Similar to camcorders, power tools also follow the pattern of heavily using a limited number of battery packs in many different products. So again, it appears there is no need for individual inquiry into each individual purchase . Just knowing the product brand, a lot can learned about what type and which manufacturers' cells were used in them.

C. Class Representatives' Purchases of At-Issue Products Can Be Verified

1. Class Representatives

168. Counsel provided me a list of class representatives' purchases between January 1, 2000 and May 31, 2011. As requested by counsel, my staff and I researched these products and verified that each contained a cylindrical LIB manufactured by the Defendants during the relevant time period. This information was verified through the use of Defendants' documents and transactional data based on markings on the outside of the class representatives' finished products and battery packs, along with publicly available data. Exhibit 10 displays the outcome of my research.

169. The list of products included laptop computers, camcorders, a power tool and a laptop replacement battery. The laptops were manufactured by Dell, Toshiba,

[87] Guerin-Calvert Report, at 79.

[88] IIT LIB-related Study Program 08-09 (September 2008), p. 51

HP, Sony and Acer. The camcorders and the replacement battery was manufactured by Sony and the power tool by Makita.

170. In most cases, publicly available product specification sheets or user manuals found on manufacturer websites were used to identify the pack model number and/or the manufacturer. Photos provided by the plaintiffs identified the exact pack model number in a few cases. For the pack model number where the manufacturer was not identified initially, my staff searched Defendant documents to identify the manufacturer of the pack number.

171. My staff then searched each of the pack numbers in defendant documents and data to identify the cell type and code. We found that these products contained cylindrical LIB cells manufactured by Sanyo, Panasonic, Sony or SDI.

2. City of Richmond Purchases

172. Counsel asked me to research City of Richmond's purchases of Dell laptop models between 2005 and 2009 to determine the manufacturers in the battery packs in them and to review defendant documents and data to determine if there is information that can be obtained with regards to the shape of the cells used in these battery packs and who may have manufactured them. Exhibit 11 displays the outcome of my research.

173. Dell's website provides a way to obtain information regarding each system configuration of each purchase via the Dell service tag number. Under the system configuration the product number of the battery pack and its manufacturer are listed. My staff researched f these models and determined the following:

a. These packs were manufactured by defendants: Panasonic, Sanyo and Sony; and

b. These packs contained cylindrical LIB cells manufactured by the respective manufacturer. This was verified by searching the part number among defendant documents which cross-referenced the part number and the cell contained within.

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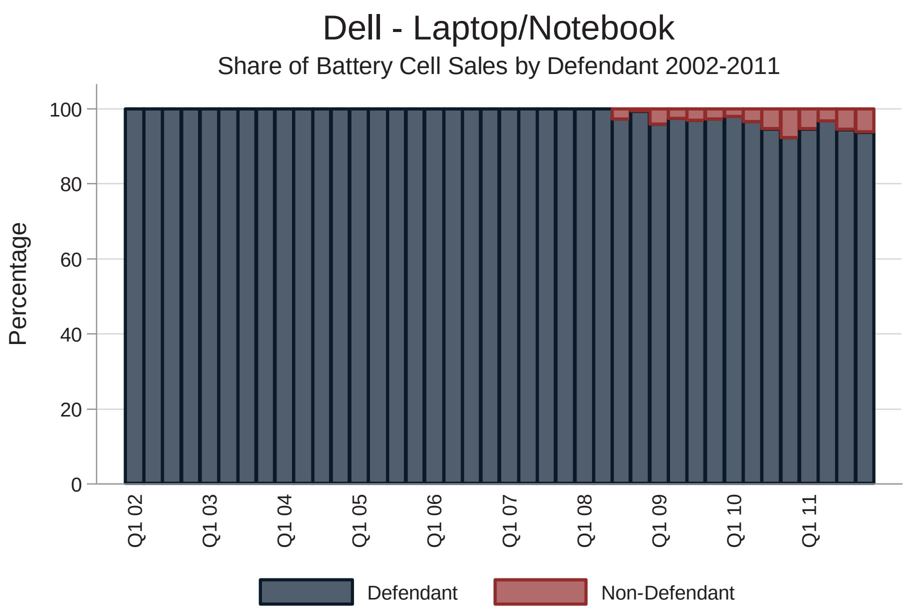
174. Industry data indicates that Dell sourced a very large fraction of its laptop cells from defendants and that over 95% of these were cylindrical. The small proportion of Dell purchases that use non-cylindrical batteries are easily identifiable and well known.[89]

Figure 33



Sources: IIT Data, LIMX2004.XLS, and LIMX2011.xls

[89] For example, the Dell Latitude 400 series uses polymer batteries, http://www.dell.com/downloads/us/products/latit/c400_spec.pdf

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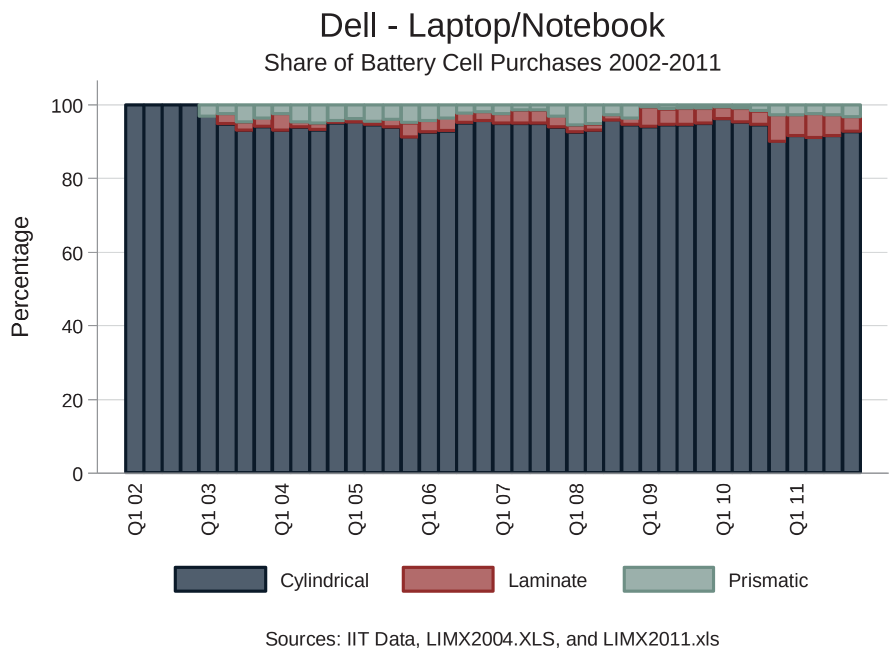
Figure 34



3. City of Palo Alto Purchases

175. Counsel also asked me to research City of Palo Alto's purchases of Toshiba laptop models between 2004 and 2011 to determine the manufacturers of the battery packs in the purchased products and to review defendant documents and data to determine if there is any information that can be obtained with regards to the shape of the cells used in these battery packs and who may have manufactured them. Exhibit 12 displays the outcome of my research.

176. Detailed product specifications by laptop model number are available in Toshiba's website, and the part number of "Primary Li Ion Battery Pack" is listed under Power Accessories in the specification sheet.[90] My staff researched each one of these models using this process and determined the following:

[90] This information can be accessed at Toshiba's website at http://support.toshiba.com/

a. These packs were manufactured by defendants: Panasonic, Sanyo and Sony. This was verified by searching the part number among defendant documents.

b. These packs contained cylindrical LIB cells manufactured by the respective manufacturer. This was verified by searching the part number among defendant documents cross-referencing the part number and the cell contained within.

Edward E. Leamer, Ph.D.
August 23, 2016

APPENDIX A. Summary of Data Used in Pass-Through Analysis

177. Figure 35 (below) provides a summary of the datasets used in pass-through analysis updated from my initial report (excluding cameras).

Figure 35

Pass-Through Analysis Data Summary

Level	Company	Product	Year Coverage	Number of Observations	Units Sold	Sales	Number of Product Models
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OEM	[redacted]	Notebook	2002-2010	473	52,076	$ 23,385,006	85
OEM	Acer	Notebook	1999-2006	467	2,287,257	1,994,191,329	108
OEM	Black and Decker	Power Tool	2006-2011	1,745	1,750,553	348,502,402	93
OEM	Cornwell	Power Tool	2006-2016	1,360	55,217	11,560,013	31
OEM	Dell	Notebook	2004-2009	1,596	3,747,724	5,128,967,876	80
OEM	Fujitsu	Notebook	2001-2011	56,943	596,793	943,044,631	33,891
OEM	HP	Notebook	2003-2009	164	34,569	27,575,765	51
OEM	JVC	Camcorder	2000-2011	6,389	10,355,577	3,330,131,624	517
OEM	Sony	Camcorder	1997-2013	8,942	27,042,252	11,909,933,304	442
OEM	Sony	Notebook	2000-2013	221,623	11,571,157	11,314,450,810	143,128
OEM	Toshiba	Notebook	1999-2011	237,510	34,096,182	27,848,062,008	146,836
Distributor	ASI	Notebook	2001-2011	3,212	186,476	105,416,197	1,150
Distributor	Ingram	Camcorder	2003-2011	4,843	195,232	60,618,476	568
Distributor	Ingram	Notebook	2003-2011	66,312	6,201,745	6,576,642,905	12,235
Distributor	SED	Notebook	2004-2009	4,586	547,813	307,227,107	1,447
Retailer	ACE Hardware	Power Tool	2010-2015	1,741	72,597	9,332,886	61
Retailer	Amazon	Notebook	2007-2008	1,272	60,845	61,364,741	335
Retailer	B&H	Camcorder	2007-2011	746	48,981	109,875,691	70
Retailer	[redacted]	Camcorder	2000-2011	1,678	13,573,005	5,148,798,618	858
Retailer	[redacted]	Notebook	2000-2011	4,087	43,576,232	30,809,816,844	2,859
Retailer	Brandsmart	Camcorder	2001-2006	1,081	32,237	15,055,653	315
Retailer	Brandsmart	Notebook	2000-2006	4,139	123,887	101,409,977	1,353
Retailer	CDW	Notebook	2009-2011	21,577	1,297,963	1,333,059,120	4,623
Retailer	Circuit City	Camcorder	1997-2009	17,966	9,007,915	4,271,684,236	714
Retailer	Circuit City	Notebook	1997-2009	18,909	9,107,798	9,436,232,381	1,437
Retailer	CompUSA	Notebook	2001-2007	18,860	8,483,614	11,191,333,259	1,612
Retailer	CompuCom	Notebook	1998-2008	7,180	586,508	1,127,026,219	1,473
Retailer	Costco	Notebook	1998-2008	3,747	1,429,121	1,720,481,488	1,675
Retailer	Crutchfield	Camcorder	2000-2011	1,682	30,027	18,410,953	170
Retailer	Fry's	Power Tool	2000-2011	5,270	109,268	3,935,537	202
Retailer	Home Depot	Power Tool	2009-2012	4,553	125,450	17,764,791	546
Retailer	Insight	Notebook	2008-2011	34,366	1,040,537	1,172,396,131	11,013
Retailer	[redacted]	Camcorder	2008-2011	1,306	22,962	6,018,823	104
Retailer	[redacted]	Notebook	2008-2011	3,883	695,844	381,977,424	517
Retailer	Nebraska FM	Notebook	1997-2008	3,661	26,292	23,313,855	1,202
Retailer	[redacted]	Camcorder	2003-2005	1,095	13,696	5,904,832	150
Retailer	[redacted]	Notebook	2002-2005	3,580	105,484	120,257,847	793
Retailer	PC Connection	Camcorder	2000-2012	6,659	151,980	57,258,762	887
Retailer	PC Connection	Notebook	2000-2012	73,574	1,638,432	2,076,189,673	16,334
Retailer	[redacted]	Camcorder	2007-2015	2,344	19,693	4,745,316	802
Retailer	[redacted]	Notebook	2007-2015	80,142	1,121,717	1,246,016,146	35,458
Total				**941,263**	**191,222,708**	**$ 140,399,370,657**	**426,225**

Note: (1) 1st and 99th percentile of prices and costs for each product-year removed as outliers.
(2) Transactions removed if notebook price<$100; camcorder price<$20; power tools<$10.
(3) Number of observations is the total number of monthly records for all model codes (annual in case of Best Buy).

Exhibit 1 – Overcharge Regression with Cells and Packs

	Cells			Cells in Packs			Pooled		
Variable	Coeff.	T-Stat	P-Val	Coeff.	T-Stat	P-Val	Coeff.	T-Stat	P-Val
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Dependent Variable									
Log Price Per Cell [1]									
Conspiracy Indicator (Jan 2000-April 2011) [2]	0.0042 *	1.70	0.0895	0.0050 ***	3.52	0.0004	0.0044 ***	3.57	0.0004
Alt. Cobalt Sensitivity Period (April 2007-Dec 2009) [3]	-0.0452 ***	-2.69	0.0071	-0.0497 ***	-4.69	0.0000	-0.0438 ***	-5.01	0.0000
Log Price Per Cell (-1)	0.8927 ***	150.50	0.0000	0.8787 ***	236.95	0.0000	0.8904 ***	294.12	0.0000
Log Cobalt Price (-3) [4]	0.0434 ***	10.65	0.0000	0.0218 ***	8.83	0.0000	0.0316 ***	15.19	0.0000
Log Cobalt Price (-6)	-0.0373 ***	-8.22	0.0000	-0.0078 ***	-2.79	0.0052	-0.0215 ***	-9.23	0.0000
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0.0229 ***	4.07	0.0000	0.0228 ***	6.53	0.0000	0.0216 ***	7.44	0.0000
Log Portable PC PPI [5]	0.0327 ***	10.42	0.0000	0.0276 ***	13.50	0.0000	0.0296 ***	17.81	0.0000
Log Housing Starts (-1) [6]	0.0213 ***	3.10	0.0019	-0.0026	-0.57	0.5669	0.0097 ***	2.66	0.0078
Log Housing Starts (-3)	-0.0322 ***	-4.54	0.0000	0.0027	0.59	0.5561	-0.0146 ***	-3.85	0.0001
Log Industrial Production Index (-1) [7]	-0.0391	-0.55	0.5857	0.2063 ***	4.52	0.0000	0.0967 **	2.57	0.0101
Log Industrial Production Index (-3)	0.1557 **	2.17	0.0299	-0.2452 ***	-5.41	0.0000	-0.0498	-1.33	0.1841
Constant	-0.5539 ***	-4.14	0.0000	0.1636 *	1.88	0.0602	-0.2378 ***	-3.37	0.0008
Fixed Effects	YES			YES			YES		
Quantity Weights	YES			YES			YES		
Observations	5,440			17,647			23,087		
R-squared	0.979			0.979			0.989		

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination
[2] Conspiracy Indicator takes the value one from January 2000-April 2011
[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009
[4] Monthly Cobalt Price /lb
[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers
[6] U.S. Annual Rate for Housing Units Starts
[7] U.S. Industrial Production Index

Source: Leamer Backup

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Exhibit 2 – Regression Using Pack Prices

Variable	Price of Pack Coeff.		T-Stat	P-Val
(1)	(8)		(9)	(10)
Dependent Variable				
Log Price Per Cell [1]				
Conspiracy Indicator (Jan 2000-April 2011) [2]	0.0050	***	3.52	0.0004
Alt. Cobalt Sensitivity Period (April 2007-Dec 2009	-0.0497	***	-4.69	0.0000
Log Price Per Cell (-1)	0.8787	***	236.95	0.0000
Log Cobalt Price (-3) [4]	0.0218	***	8.83	0.0000
Log Cobalt Price (-6)	-0.0078	***	-2.79	0.0052
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0.0228	***	6.53	0.0000
Log Portable PC PPI [5]	0.0276	***	13.50	0.0000
Log Housing Starts (-1) [6]	-0.0026		-0.57	0.5669
Log Housing Starts (-3)	0.0027		0.59	0.5561
Log Industrial Production Index (-1) [7]	0.2063	***	4.52	0.0000
Log Industrial Production Index (-3)	-0.2452	***	-5.41	0.0000
Constant	0.3815	***	4.29	0.0000
Fixed Effects	YES			
Quantity Weights	YES			
Observations	17,647			
R-squared	0.989			

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average pack price weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination

[2] Conspiracy Indicator takes the value one from January 2000-April 2011

[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009

[4] Monthly Cobalt Price /lb

[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers

[6] U.S. Annual Rate for Housing Units Starts

[7] U.S. Industrial Production Index

Source: Leamer Backup

Exhibit 3 – Reasons for Data Dropped from Overcharge Regression Cell (By Transaction)

Year	Total Obs	Dropped Obs	Flagged Outlier	Missing Number of Cells	Missing Cell vs Pack	Missing Dimension	Quantity not Round Number	Missing Capacity	Dropped 2014
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1997	2,195	696	37	9	37	0	0	631	0
1998	2,999	492	30	2	36	3	0	432	0
1999	3,594	804	63	2	23	7	0	736	0
2000	3,958	1,281	74	26	52	157	0	1,185	0
2001	6,583	1,559	201	64	36	235	0	1,403	0
2002	12,431	2,042	404	117	11	385	0	1,774	0
2003	22,189	1,864	505	118	20	219	1	1,514	0
2004	19,757	1,274	411	21	29	10	0	953	0
2005	25,031	2,188	500	49	22	5	0	1,793	0
2006	39,267	2,689	645	49	29	53	0	2,197	0
2007	40,882	2,116	620	21	42	85	0	1,560	0
2008	31,400	1,312	460	24	54	7	0	844	0
2009	35,957	997	522	16	59	0	0	443	0
2010	43,966	1,468	831	30	73	0	0	607	0
2011	47,820	2,402	643	16	72	81	15	1,790	0
2012	50,513	4,356	948	90	139	703	47	3,552	0
2013	40,120	4,638	831	295	336	1,068	19	4,095	0
2014	559	559	3	7	0	0	2	315	559
Total	**429,221**	**32,737**	**7,728**	**956**	**1,070**	**3,018**	**84**	**25,824**	**559**

Year	Dropped Obs as a Share of Total Sample	Share of Dropped Observations: Flagged Outlier	Missing Number of Cells	Missing Cell vs Pack	Missing Dimension	Quantity not Round Number	Missing Capacity	Dropped 2014
(1)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
1997	31.7 %	5.3 %	1.3 %	5.3 %	0.0 %	0.0 %	90.7 %	0.0 %
1998	16.4	6.1	0.4	7.3	0.6	0.0	87.8	0.0
1999	22.4	7.8	0.2	2.9	0.9	0.0	91.5	0.0
2000	32.4	5.8	2.0	4.1	12.3	0.0	92.5	0.0
2001	23.7	12.9	4.1	2.3	15.1	0.0	90.0	0.0
2002	16.4	19.8	5.7	0.5	18.9	0.0	86.9	0.0
2003	8.4	27.1	6.3	1.1	11.7	0.1	81.2	0.0
2004	6.4	32.3	1.6	2.3	0.8	0.0	74.8	0.0
2005	8.7	22.9	2.2	1.0	0.2	0.0	81.9	0.0
2006	6.8	24.0	1.8	1.1	2.0	0.0	81.7	0.0
2007	5.2	29.3	1.0	2.0	4.0	0.0	73.7	0.0
2008	4.2	35.1	1.8	4.1	0.5	0.0	64.3	0.0
2009	2.8	52.4	1.6	5.9	0.0	0.0	44.4	0.0
2010	3.3	56.6	2.0	5.0	0.0	0.0	41.3	0.0
2011	5.0	26.8	0.7	3.0	3.4	0.6	74.5	0.0
2012	8.6	21.8	2.1	3.2	16.1	1.1	81.5	0.0
2013	11.6	17.9	6.4	7.2	23.0	0.4	88.3	0.0
2014	100.0	0.5	1.3	0.0	0.0	0.4	56.4	100.0
Overall	**7.6 %**	**23.6 %**	**2.9 %**	**3.3 %**	**9.2 %**	**0.3 %**	**78.9 %**	**1.7 %**

Notes: Since categories are not mutually exclusive, the sum of observations in columns (4) - (10) does not equal column (3)
Source: Defendant Transaction Data and Leamer Overcharge Regression

Exhibit 4 – Reasons for Data Dropped from Overcharge Regression Cell (By Cell Quantity)

Year	Total Quantity	Total Cell Quantity	Quantity of Cells Dropped	Flagged Outlier	Missing Number of Cells[1]	Missing Cell vs Pack	Missing Dimension	Quantity not Round Number	Missing Capacity	Dropped 2014
	(Thousands)									
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1997	22,316	78,060	30,692	245	2	2	0	0	30,610	0
1998	38,630	105,569	23,824	1,013	160	2	160	0	22,971	0
1999	53,116	127,022	28,972	647	400	129	528	0	28,760	0
2000	66,484	157,918	33,654	1,574	20	7	2,013	0	33,202	0
2001	87,944	192,666	38,884	7,953	350	91	9,046	0	36,807	0
2002	109,984	240,048	37,526	9,694	828	491	3,678	0	31,013	0
2003	191,092	364,892	40,511	10,523	63	1	524	3	30,689	0
2004	190,605	353,447	30,456	7,599	3	222	111	0	24,487	0
2005	280,336	479,011	63,457	7,310	80	741	2	0	55,920	0
2006	411,363	660,935	95,443	8,786	128	215	358	0	87,698	0
2007	534,874	846,423	120,018	11,471	205	399	220	0	109,509	0
2008	628,918	1,036,003	86,830	4,404	266	10,135	5	0	72,124	0
2009	766,524	1,271,124	51,982	7,034	304	22,932	0	0	22,038	0
2010	949,049	1,660,787	77,745	16,232	514	19,334	0	0	42,388	0
2011	990,579	1,828,550	128,868	28,708	490	15,872	176	244	88,922	0
2012	982,884	1,924,642	183,074	23,659	1,177	1,945	15,487	1,881	150,631	0
2013	1,059,780	1,710,858	191,278	17,223	4,018	4,923	14,865	532	169,084	0
2014	23,441	36,978	36,978	7	385	0	0	0	21,419	36,978
Total	**7,387,918**	**13,074,933**	**1,300,192**	**164,082**	**9,392**	**77,440**	**47,173**	**2,660**	**1,058,273**	**36,978**

Year	Dropped Quantity as a Share of Total Quantity	Share of Dropped Quantity: Flagged Outlier	Missing Number of Cells	Missing Cell vs Pack	Missing Dimension	Quantity not Round Number	Missing Capacity	Dropped 2014
(1)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
1997	39.3 %	0.8 %	0.0 %	0.0 %	0.0 %	0.0 %	99.7 %	0.0 %
1998	22.6	4.3	0.7	0.0	0.7	0.0	96.4	0.0
1999	22.8	2.2	1.4	0.4	1.8	0.0	99.3	0.0
2000	21.3	4.7	0.1	0.0	6.0	0.0	98.7	0.0
2001	20.2	20.5	0.9	0.2	23.3	0.0	94.7	0.0
2002	15.6	25.8	2.2	1.3	9.8	0.0	82.6	0.0
2003	11.1	26.0	0.2	0.0	1.3	0.0	75.8	0.0
2004	8.6	25.0	0.0	0.7	0.4	0.0	80.4	0.0
2005	13.2	11.5	0.1	1.2	0.0	0.0	88.1	0.0
2006	14.4	9.2	0.1	0.2	0.4	0.0	91.9	0.0
2007	14.2	9.6	0.2	0.3	0.2	0.0	91.2	0.0
2008	8.4	5.1	0.3	11.7	0.0	0.0	83.1	0.0
2009	4.1	13.5	0.6	44.1	0.0	0.0	42.4	0.0
2010	4.7	20.9	0.7	24.9	0.0	0.0	54.5	0.0
2011	7.0	22.3	0.4	12.3	0.1	0.2	69.0	0.0
2012	9.5	12.9	0.6	1.1	8.5	1.0	82.3	0.0
2013	11.2	9.0	2.1	2.6	7.8	0.3	88.4	0.0
2014	100.0	0.0	1.0	0.0	0.0	0.0	57.9	100.0
Overall	**9.9 %**	**12.6 %**	**0.7 %**	**6.0 %**	**3.6 %**	**0.2 %**	**81.4 %**	**2.8 %**

Notes: Since categories are not mutually exclusive, the sum of quantity in columns (4) - (11) does not equal column (3)
[1]When number of cells is missing, we have assumed one cell to describe a minimum quantity of cells for dropped observations.

Source: Defendant Transaction Data and Leamer Overcharge Regression

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Exhibit 5 – Outliers Retained

Variable	Cells Coeff.	Cells T-Stat	Cells P-Val	Cells in Packs Coeff.	Cells in Packs T-Stat	Cells in Packs P-Val
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable						
Log Price Per Cell [1]						
Conspiracy Indicator (Jan 2000-April 2011)[2]	0.0043 *	1.72	0.0864	0.0231 ***	11.21	0.0000
Alt. Cobalt Sensitivity Period (April 2007-Dec 2009	-0.0455 ***	-2.72	0.0066	-0.1826 ***	-11.81	0.0000
Log Price Per Cell (-1)	0.8921 ***	150.53	0.0000	0.5693 ***	130.13	0.0000
Log Cobalt Price (-3) [4]	0.0435 ***	10.68	0.0000	0.0428 ***	11.83	0.0000
Log Cobalt Price (-6)	-0.0373 ***	-8.24	0.0000	-0.0028	-0.68	0.4936
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0.0230 ***	4.10	0.0000	0.0764 ***	15.02	0.0000
Log Portable PC PPI [5]	0.0328 ***	10.45	0.0000	0.0997 ***	34.35	0.0000
Log Housing Starts (-1) [6]	0.0213 ***	3.10	0.0019	-0.0133 **	-2.03	0.0427
Log Housing Starts (-3)	-0.0322 ***	-4.53	0.0000	0.0072	1.05	0.2918
Log Industrial Production Index (-1) [7]	-0.0403	-0.56	0.5732	-0.0672	-1.01	0.3143
Log Industrial Production Index (-3)	0.1562 **	2.18	0.0293	-0.3514 ***	-5.29	0.0000
Constant	-0.5506 ***	-4.12	0.0000	1.9540 ***	15.48	0.0000
Fixed Effects	YES			YES		
Quantity Weights	YES			YES		
Observations	5,495			19,043		
R-squared	0.979			0.954		
Weighted Average Overcharge Percent	18.6194			12.1992		

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination. Outliers Retained.

[2] Conspiracy Indicator takes the value one from January 2000-April 2011

[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009

[4] Monthly Cobalt Price /lb

[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers

[6] U.S. Annual Rate for Housing Units Starts

[7] U.S. Industrial Production Index

Source: Leamer Backup

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Exhibit 6 – Missing Capacities Retained

Variable	Cells Coeff.		Cells T-Stat	Cells P-Val	Cells in Packs Coeff.		Cells in Packs T-Stat	Cells in Packs P-Val
(1)	(2)		(3)	(4)	(5)		(6)	(7)
Dependent Variable								
Log Price Per Cell [1]								
Conspiracy Indicator (Jan 2000-April 2011)[2]	0.0054	**	2.35	0.0186	0.0063	***	4.85	0.0000
Alt. Cobalt Sensitivity Period (April 2007-Dec 2009	-0.0506	***	-3.12	0.0018	-0.0499	***	-4.84	0.0000
Log Price Per Cell (-1)	0.9017	***	168.29	0.0000	0.8732	***	253.72	0.0000
Log Cobalt Price (-3) [4]	0.0431	***	10.99	0.0000	0.0211	***	8.80	0.0000
Log Cobalt Price (-6)	-0.0385	***	-8.82	0.0000	-0.0063	**	-2.33	0.0196
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0.0244	***	4.50	0.0000	0.0234	***	6.91	0.0000
Log Portable PC PPI [5]	0.0233	***	8.61	0.0000	0.0272	***	14.98	0.0000
Log Housing Starts (-1) [6]	0.0238	***	3.56	0.0004	0.0002		0.05	0.9566
Log Housing Starts (-3)	-0.0293	***	-4.24	0.0000	0.0026		0.57	0.5675
Log Industrial Production Index (-1) [7]	-0.0362		-0.52	0.6042	0.2208	***	4.92	0.0000
Log Industrial Production Index (-3)	0.1336	*	1.91	0.0567	-0.2724	***	-6.12	0.0000
Constant	-0.4668	***	-3.60	0.0003	0.2082	**	2.50	0.0123
Fixed Effects	YES				YES			
Quantity Weights	YES				YES			
Observations	6,273				20,456			
R-squared	0.977				0.977			
Weighted Average Overcharge Percent	21.1822				14.8150			

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination. Missing Capacities retained.
[2] Conspiracy Indicator takes the value one from January 2000-April 2011
[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009
[4] Monthly Cobalt Price /lb
[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers
[6] U.S. Annual Rate for Housing Units Starts
[7] U.S. Industrial Production Index

Source: Leamer Backup

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Exhibit 7 – Weighted and Unweighted Cells Overcharge Regression

	Weighted			Unweighted		
Variable	Coeff.	T-Stat	Std. Err	Coeff.	T-Stat	Std. Err
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable						
Log Price Per Cell [1]						
Conspiracy Indicator (Jan 2000-April 2011) [2]	0.0042 *	1.70	0.0025	-0.0144 ***	-2.65	0.0054
Alt. Cobalt Sensitivity Period (April 2007-Dec 2009) [3]	-0.0452 ***	-2.69	0.0168	-0.1026 ***	-2.58	0.0398
Log Price Per Cell (-1)	0.8927 ***	150.50	0.0059	0.7529 ***	80.14	0.0094
Log Cobalt Price (-3) [4]	0.0434 ***	10.65	0.0041	0.0457 ***	4.73	0.0097
Log Cobalt Price (-6)	-0.0373 ***	-8.22	0.0045	-0.0217 **	-2.16	0.0101
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0.0229 ***	4.07	0.0056	0.0412 ***	3.20	0.0129
Log Portable PC PPI [5]	0.0327 ***	10.42	0.0031	0.0513 ***	8.38	0.0061
Log Housing Starts (-1) [6]	0.0213 ***	3.10	0.0069	-0.0113	-0.60	0.0189
Log Housing Starts (-3)	-0.0322 ***	-4.54	0.0071	-0.0275	-1.42	0.0194
Log Industrial Production Index (-1) [7]	-0.0391	-0.55	0.0716	0.3879 **	2.10	0.1847
Log Industrial Production Index (-3)	0.1557 **	2.17	0.0717	-0.4087 **	-2.19	0.1862
Constant	-0.5539 ***	-4.14	0.1338	0.2848	0.91	0.3133
Fixed Effects	YES			YES		
Quantity Weights	YES			NO		
Observations	5,440			5,440		
R-squared	0.979			0.875		

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination

[2] Conspiracy Indicator takes the value one from January 2000-April 2011

[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009

[4] Monthly Cobalt Price /lb

[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers

[6] U.S. Annual Rate for Housing Units Starts

[7] U.S. Industrial Production Index

Source: Leamer Backup

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Exhibit 8 – Weighted and Unweighted Cells in Packs Overcharge Regression

	Weighted			Unweighted		
Variable	Coeff.	T-Stat	Std. Err	Coeff.	T-Stat	Std. Err
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable						
Log Price Per Cell [1]						
Conspiracy Indicator (Jan 2000-April 2011)[2]	0.0050 ***	3.52	0.0014	0.0139 ***	5.16	0.0027
Alt. Cobalt Sensitivity Period (April 2007-Dec 2009)[3]	-0.0497 ***	-4.69	0.0106	-0.0935 ***	-4.45	0.0210
Log Price Per Cell (-1)	0.8787 ***	236.95	0.0037	0.7910 ***	168.13	0.0047
Log Cobalt Price (-3) [4]	0.0218 ***	8.83	0.0025	0.0214 ***	4.63	0.0046
Log Cobalt Price (-6)	-0.0078 ***	-2.79	0.0028	0.0004	0.08	0.0048
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0.0228 ***	6.53	0.0035	0.0332 ***	4.92	0.0068
Log Portable PC PPI [5]	0.0276 ***	13.50	0.0020	0.0022	0.80	0.0027
Log Housing Starts (-1) [6]	-0.0026	-0.57	0.0045	0.0018	0.17	0.0103
Log Housing Starts (-3)	0.0027	0.59	0.0046	0.0094	0.89	0.0105
Log Industrial Production Index (-1) [7]	0.2063 ***	4.52	0.0456	0.1282	1.31	0.0977
Log Industrial Production Index (-3)	-0.2452 ***	-5.41	0.0453	-0.3653 ***	-3.71	0.0986
Constant	0.1636 *	1.88	0.0870	1.2638 ***	8.04	0.1571
Fixed Effects	YES			YES		
Quantity Weights	YES			NO		
Observations	17,647			17,647		
R-squared	0.979			0.918		

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination

[2] Conspiracy Indicator takes the value one from January 2000-April 2011

[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009

[4] Monthly Cobalt Price /lb

[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers

[6] U.S. Annual Rate for Housing Units Starts

[7] U.S. Industrial Production Index

Source: Leamer Backup

Exhibit 9 – Overcharge Regression with Nickel Prices

	Cells			Cells in Packs		
Variable	Coeff.	T-Stat	P-Val	Coeff.	T-Stat	P-Val
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable						
Log Price Per Cell [1]						
Conspiracy Indicator (Jan 2000-April 2011)[2]	0.0023	0.90	0.3670	0.0038 ***	2.63	0.0084
Alt. Cobalt Sensitivity Period (April 2007-Dec 2009	-0.0865 ***	-4.80	0.0000	-0.0593 ***	-5.35	0.0000
Log Price Per Cell (-1)	0.8907 ***	150.30	0.0000	0.8789 ***	237.10	0.0000
Log Cobalt Price (-3) [4]	0.0338 ***	7.77	0.0000	0.0199 ***	7.38	0.0000
Log Cobalt Price (-6)	-0.0387 ***	-7.96	0.0000	-0.0091 ***	-3.03	0.0024
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0.0368 ***	6.08	0.0000	0.0260 ***	7.11	0.0000
Log Portable PC PPI [5]	0.0291 ***	9.02	0.0000	0.0266 ***	12.77	0.0000
Log Housing Starts (-1) [6]	0.0332 ***	4.67	0.0000	0.0005	0.11	0.9120
Log Housing Starts (-3)	-0.0310 ***	-4.25	0.0000	0.0049	1.03	0.3035
Log Industrial Production Index (-1) [7]	-0.2404 ***	-3.05	0.0023	0.1421 ***	2.81	0.0050
Log Industrial Production Index (-3)	0.2065 ***	2.82	0.0048	-0.2435 ***	-5.24	0.0000
Log Nickel Price Index (-3) [8]	0.0228 ***	5.44	0.0000	0.0044	1.59	0.1110
Log Nickel Price Index (-6)	-0.0040	-0.88	0.3813	0.0030	1.04	0.2971
Constant	-0.0892	-0.52	0.6011	0.3559 ***	3.37	0.0008
Fixed Effects	YES			YES		
Quantity Weights	YES			YES		
Observations	5,440			17,550		
R-squared	0.979			0.979		
Adj. R-squared	0.978			0.978		
Weighted Average Overcharge Percent	18.6322			13.3151		

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination

[2] Conspiracy Indicator takes the value one from January 2000-April 2011

[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009

[4] Monthly Cobalt Price /lb

[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers

[6] U.S. Annual Rate for Housing Units Starts

[7] U.S. Industrial Production Index

[8] Indexed Monthly Price of Nickel, Indexed to January 2000

Source: Leamer Backup, Guerin-Calvert Backup

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Exhibit 10 – Overcharge Regression with Global Notebook PC Sales

	Cells			Cells in Packs		
Variable	Coeff.	T-Stat	P-Val	Coeff.	T-Stat	P-Val
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable						
Log Price Per Cell [1]						
Conspiracy Indicator (Jan 2000-April 2011)[2]	0.0045 *	1.80	0.0719	0.0048 ***	3.39	0.0007
Alt. Cobalt Sensitivity Period (April 2007-Dec 2009	-0.0542 ***	-3.14	0.0017	-0.0537 ***	-4.96	0.0000
Log Price Per Cell (-1)	0.8919 ***	149.50	0.0000	0.8785 ***	236.14	0.0000
Log Cobalt Price (-3) [4]	0.0422 ***	10.31	0.0000	0.0212 ***	8.49	0.0000
Log Cobalt Price (-6)	-0.0396 ***	-8.25	0.0000	-0.0094 ***	-3.23	0.0012
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0.0256 ***	4.43	0.0000	0.0241 ***	6.78	0.0000
Log Portable PC PPI [5]	0.0380 ***	7.33	0.0000	0.0325 ***	9.82	0.0000
Log Housing Starts (-1) [6]	0.0222 ***	3.20	0.0014	-0.0016	-0.35	0.7299
Log Housing Starts (-3)	-0.0305 ***	-4.17	0.0000	0.0049	1.03	0.3046
Log Industrial Production Index (-1) [7]	-0.0728	-0.98	0.3281	0.1786 ***	3.74	0.0002
Log Industrial Production Index (-3)	0.1893 **	2.57	0.0101	-0.2228 ***	-4.77	0.0000
Log Quarterly Notebook PC Sales [8]	0.0174 **	2.40	0.0166	0.0072	1.55	0.1201
Log Notebook PC Sales (Previous Quarter)	-0.0076	-1.08	0.2801	0.0019	0.43	0.6701
Constant	-0.6168 ***	-4.47	0.0000	0.1208	1.35	0.1779
Fixed Effects	YES			YES		
Quantity Weights	YES			YES		
Observations	5,440			17,647		
R-squared	0.979			0.979		
Adj. R-squared	0.978			0.978		
Weighted Average Overcharge Percent	18.8047			13.9156		

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination

[2] Conspiracy Indicator takes the value one from January 2000-April 2011

[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009

[4] Monthly Cobalt Price /lb

[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers

[6] U.S. Annual Rate for Housing Units Starts

[7] U.S. Industrial Production Index

[8] Total Quarterly Sales of Notebook PCs in Millions

Source: Leamer Backup, Noll Backup

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Exhibit 11 – Overcharge Regression without Heightened Cobalt Sensitivity

	Cells			Cells in Packs		
Variable	Coeff.	T-Stat	P-Val	Coeff.	T-Stat	P-Val
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Dependent Variable						
Log Price Per Cell [1]						
Conspiracy Indicator (Jan 2000-April 2011)[2]	0.0046 *	1.87	0.0614	0.0049 ***	3.49	0.0005
Log Price Per Cell (-1)	0.9242 ***	173.91	0.0000	0.8978 ***	254.71	0.0000
Log Cobalt Price (-3) [3]	0.0507 ***	12.54	0.0000	0.0288 ***	11.89	0.0000
Log Cobalt Price (-6)	-0.0319 ***	-8.11	0.0000	-0.0008	-0.34	0.7303
Log Portable PC PPI [4]	0.0246 ***	7.93	0.0000	0.0220 ***	10.89	0.0000
Log Housing Starts (-1) [5]	0.0197 ***	2.84	0.0046	-0.0043	-0.96	0.3392
Log Housing Starts (-3)	-0.0289 ***	-4.03	0.0001	0.0080 *	1.71	0.0865
Log Industrial Production Index (-1) [6]	-0.3235 ***	-4.90	0.0000	-0.0799 *	-1.93	0.0538
Log Industrial Production Index (-3)	0.4546 ***	7.35	0.0000	0.0563	1.46	0.1435
Constant	-0.6491 ***	-5.18	0.0000	0.0340	0.43	0.6699
Fixed Effects	YES			YES		
Quantity Weights	YES			YES		
Observations	5,440			17,647		
R-squared	0.978			0.978		
Adj. R-squared	0.978			0.978		
Weighted Average Overcharge Percent	6.1860			4.8088		

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination
[2] Conspiracy Indicator takes the value one from January 2000-April 2011
[3] Monthly Cobalt Price /lb
[4] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers
[5] U.S. Annual Rate for Housing Units Starts
[6] U.S. Industrial Production Index

Source: Leamer Backup

Exhibit 12 - Class Representatives Purchases List

Plaintiffs	State	Purchase Date (Jan 1, 2000 – May 31, 2011)	Relevant Purchase [finished product]	Battery Pack Manufacturer	Battery Cell Manufacturer	Cell Type & Cell Model Number
Piya Robert Rojanasathit	California	August 1, 2009	Dell Studio 15 laptop Dell Service Tag No. 2F5S7K1	Sanyo JWPHF (IPP-ROJANASATHIT00000008A SANYO0432726)	Sanyo (SANYO0432726)	Cylindrical UR18650FM (SANYO0432726)
Linda Lincoln	West Virginia	July 3, 2005	Dell Inspiron 15 N5030 laptop Model No. iN5030-239983D Express Service Code: 34742437885 Dell Service Tag: FYKR0N1 Serial No. CN-0N7J7M-70166-0CS-07TQ-A00 (D P/N 0N7J7M))	Sanyo J1KND (IPP-LINCOLN00000188A IPP-LINCOLN00000190A SANYO0432726)	Sanyo (SANYO0432726)	Cylindrical UR18650A (SANYO0432726)
Donna Shawn	Michigan	July 16, 2006	Dell Inspiron 1505 laptop Dell Service Tag No. 5MY7CB1 Serial No. CN-OKD882-48643-5139	Simplo UD265 (Dell Website)	Panasonic or LGC (LGC-MDL0223900 SANYO0000226)	Cylindrical (SANYO0000226)
Jason Ames	Maine	June 28, 2005	Makita Cordless drill Model No. BDF452 Serial No. 0418165 Y	Sony 95% / Samsung 5% BL 1830 (Makita Website)	Sony / Samsung (SONY-LIB-001057495 SDI-B-000032936)	Cylindrical US18650V1/VTC1/VT1 (Sony) INR18650-15Q (Samsung) (SONY-LIB-001057495 SDI-B-000032936)
Jason Ames	Maine	November 22, 2008	Sony Mini DV camcorder Model No. DCR-HC96 Serial No. 190268759064	Sony NP-FP50 (Sony Website; SONY_LIB_DATA_18095)	Sony (SONY-LIB-000941098)	Cylindrical US14430G6 (SONY-LIB-000941098)
Christopher Hunt	Arizona	September 5, 2003	Sony GRZ 660 laptop Model No. PCG-GRZ660 Serial No. 3105483	Sony PCGA-BP2NX (Sony Website; SONY-LIB-000430187)	Sony (SONY-LIB-000430187)	Cylindrical US18650G4P (SONY-LIB-000430187)
John Kopp	Illinois	August 20, 2005	Dell Inspiron 6000 Dell Service Tag: 11S0981 Express Service Code: 2284289713 Serial No. JP-0C5447-42016-6BE-1069	Sanyo F5133 (Dell Website)	Sanyo (SANYO0000243)	Cylindrical UR18650FK (SANYO0000243)

Exhibit 12 - Class Representatives Purchases List

Plaintiffs	State	Purchase Date (Jan 1, 2000 – May 31, 2011)	Relevant Purchase [finished product]	Battery Pack Manufacturer	Battery Cell Manufacturer	Cell Type & Cell Model Number
Bradley Van Patten	Wisconsin	October 7, 2008	Sony Vaio laptop (replacement battery) Model No. VGP-BPS9/B	Sony VGP-BPS9/B (SONY-LIB-000820615)	Sony / Sanyo (SONY-LIB-000820615)	Cylindrical US18650G7C (Sony) UR18650F (Sanyo) (SONY-LIB-000820615)
Patrick McGuinness	Florida	around 2003 (approx.)	Sony DCR-TRV103 camcorder Model No: DCR-TRV103 Battery Model No: NP-F330	Sony NP-F330 (Sony Website)	Sony (SONY-LIB-DATA-0004)	Cylindrical US18500E (SONY-LIB-DATA-0004)
David Tolchin	New York	January 2, 2008	Dell Latitude D830 (Intel Core 2 Duo T7500) Dell Service Tag: 1J3DDF1 Express Service Code: 3331302445	SIMPLO WN979 (Dell Website)	Sanyo (Dell Website; SANYO0437203)	Cylindrical UR18650F (SANYO0437203)
David Tolchin	New York	September 17, 2009	Dell Inspiron 10 1010 Mini laptop Dell Service Tag: H92VQK1 Express Service Code: 37554335281	Samsung J654N (Dell Website)	Samsung SDI and LGC (SDI-B-000038214 LGC-MDL0856608)	Cylindrical (SDI-B-000038214)
Joseph O'Daniel	Missouri	December 28, 2009	HP-DV6 1355dxl laptop Model No. DV6 1355dx Product No. VM222UA#ABA Serial No. CNF9456HL9	SONY/Sanyo/SDI/LGC/Panasonic (SONY-LIB-001057495)	SONY (SONY-LIB-001057495)	Cylindrical US18650G6F (Sony) (SONY-LIB-001057495)
Christopher Bessette	South Dakota	July 8, 2007	Toshiba Satellite A215-S4757 laptop Model Name: A215-S4757 Part No. PSAEGU-01100U Serial No. 67357525K	Panasonic PA3534U-1BRS (Toshiba Website; PANA-C000388523)	Panasonic (PANA-C000113415)	Cylindrical CGR18650CE (PANA-C000113415)
Steven Bugge	California	December 1, 2010	Toshiba Satellite L655-S5096 laptop Model Name: L655-S5096 Part No. PSK2CU-01Q01S Serial No. XA020001W	Panasonic PA3818U-1BRS (Toshiba Website; PANA-C000126910)	Panasonic (PANA-C000126910)	Cylindrical CGR18650CGT NCR18650TC (PANA-C000126910)

Exhibit 12 - Class Representatives Purchases List

Plaintiffs	State	Purchase Date (Jan 1, 2000 – May 31, 2011)	Relevant Purchase [finished product]	Battery Pack Manufacturer	Battery Cell Manufacturer	Cell Type & Cell Model Number
Tom Pham	California	September 18, 2006	Dell XPS M1210 Intel Core 2 Duo Processor T5600 laptop Model No. XPS M1210 MXC062 Dell Service Tag: HRX6TB1 Express Service Code: 38693631709	SDI YF093 (Dell Website)	SDI (SDI-B-000077123)	Cylindrical (SONY-LIB-000819011)
Patrick McGuinness	Florida	January 25, 2011	Sony Vaio laptop Model no. WFW9700VA01 Serial no. HLY0207096 Service Tag: C606Q31U	SONY VGP-BPS22 or VGP-BPS22A (Sony Website; IPP-MCGUINNESS00000010A; SONY-LIB-000820615)	Sony / Panasonic / Sanyo (SONY-LIB-000820615)	Cylindrical US18650G6E (Sony) NCR18650 (Panasonic) ICR18650-20F (Samsung) (SONY-LIB-000820615)
Bradley Seldin	Florida	November 1, 2008	Acer Aspire 1410-2099 laptop Model No. ZH7 Serial No. 93703112025	Panasonic CGR-B/6P3 (IPP-SELDIN00000002A)	Panasonic (PANA-C000038788E)	Cylindrical CGR18650CG (PANA-C000038788E)
City of Palo Alto	Gov't Entities		Portege R700-s1322	Panasonic PA3832U-1BRS (Toshiba Website; PANA-C000126910)	Panasonic (PANA-C000126910)	Cylindrical NCR18650AB (PANA-C000126910)
Cindy Booze	Nebraska	March 5, 2007	Toshiba Satellite A135-S4467 laptop Model Name: A135-S4467 Part No. PSAD0U-03M00P Serial No. 17237434K	Panasonic PA3465U-1BRS (Toshiba Website; PANA-C000388523)	Panasonic (PANA-C000113415)	Cylindrical CGR18650CE (PANA-C000113415)
Matthew Ence	Nevada	June 29, 2005	Toshiba Satellite L35-S2174 laptop Model Name: L35-S2174 Part No. PSL33U-02601W	Panasonic PA3506U-1BRS (Toshiba Website; PANA-C000388523)	Panasonic (PANA-C000113415)	Cylindrical CGR18650CE (PANA-C000113415)

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Exhibit 13 - City of Richmond Dell Laptops Purchased Between 2005 and 2009

Service Tag	Brand Descripton	Ship Date	Battery Pack Manufacturer	Dell's Battery Part Number	Cell Model	Cell Type	Cell Manufacturer
HCTC071	LATITUDE D810	March 22, 2005	SANYO	D5505	UR18650F	Cylindrical	SANYO
F729B71	LATITUDE D810	April 29, 2005	SANYO	D5505	UR18650F	Cylindrical	SANYO
5457T71	INSPIRON 9300	July 6, 2005	SANYO	C5447	UR18650F	Cylindrical	SANYO
8CS8T71	LATITUDE D810	July 6, 2005	SONY	C5340	US18650G7	Cylindrical	SONY
1089T71	INSPIRON 6000	July 7, 2005	SANYO	F5133	UR18650F	Cylindrical	SANYO
D4S4T71	LATITUDE D810	July 7, 2005	SONY	C5340	US18650G7	Cylindrical	SONY
54S4T71	LATITUDE D810	July 7, 2005	SONY	C5340	US18650G7	Cylindrical	SONY
73Q3981	INSPIRON 600M	August 25, 2005	SANYO	Y1338	UR18650F	Cylindrical	SANYO
J2Q3981	INSPIRON 600M	August 25, 2005	SANYO	Y1338	UR18650F	Cylindrical	SANYO
6LVZK81	INSPIRON 9300	October 3, 2005	SANYO	C5447	UR18650F	Cylindrical	SANYO
572QL81	LATITUDE D610	October 7, 2005	SANYO	Y1338	UR18650F	Cylindrical	SANYO
8XLP191	INSPIRON 9300	December 23, 2005	SONY	C5446	US18650G7	Cylindrical	SONY
41V9K91	LATITUDE D610	March 1, 2006	SONY	C2603	US18650G7	Cylindrical	SONY
B0V9K91	LATITUDE D610	March 1, 2006	SONY	C2603	US18650G7	Cylindrical	SONY
50V9K91	LATITUDE D610	March 1, 2006	SONY	C2603	US18650G7	Cylindrical	SONY
2DC7R91	LATITUDE D610	April 5, 2006	SANYO	Y1338	UR18650F	Cylindrical	SANYO
1HC7R91	LATITUDE D610	April 5, 2006	SANYO	Y1338	UR18650F	Cylindrical	SANYO
6FC7R91	LATITUDE D610	April 5, 2006	SANYO	Y1338	UR18650F	Cylindrical	SANYO
CS64NB1	LATITUDE D620	August 23, 2006	PANASONIC	JD606	CGR18650E	Cylindrical	PANASONIC
19DVNB1	LATITUDE D620	August 28, 2006	PANASONIC	JD606	CGR18650E	Cylindrical	PANASONIC
1ZTWZB1	LATITUDE D620	October 24, 2006	SANYO	JD605	UR18650F	Cylindrical	SANYO
8YTWZB1	LATITUDE D620	October 24, 2006	SANYO	JD605	UR18650F	Cylindrical	SANYO
3XTWZB1	LATITUDE D620	October 24, 2006	SANYO	JD605	UR18650F	Cylindrical	SANYO
9BKBFC1	LATITUDE D620	January 27, 2007	PANASONIC	JD606	CGR18650E	Cylindrical	PANASONIC
6NKBFC1	LATITUDE D620	January 27, 2007	PANASONIC	JD606	CGR18650E	Cylindrical	PANASONIC
B9KBFC1	LATITUDE D620	January 27, 2007	PANASONIC	JD606	CGR18650E	Cylindrical	PANASONIC

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Exhibit 13 - City of Richmond Dell Laptops Purchased Between 2005 and 2009

Service Tag	Brand Descripton	Ship Date	Battery Pack Manufacturer	Dell's Battery Part Number	Cell Model	Cell Type	Cell Manufacturer
9LKBFC1	LATITUDE D620	January 27, 2007	PANASONIC	JD606	CGR18650E	Cylindrical	PANASONIC
3Z4TFC1	LATITUDE D620	January 30, 2007	SANYO	JD605	UR18650F	Cylindrical	SANYO
GY4TFC1	LATITUDE D620	January 30, 2007	SANYO	JD605	UR18650F	Cylindrical	SANYO
4Y4TFC1	LATITUDE D620	January 30, 2007	SANYO	JD605	UR18650F	Cylindrical	SANYO
HVWYYC1	LATITUDE D620	May 18, 2007	SANYO	JN146	UR18650F	Cylindrical	SANYO
1Q56HD1	LATITUDE D531	August 19, 2007	SANYO	MM158	UR18650F	Cylindrical	SANYO
F89MHD1	PRECISION M90	August 24, 2007	SANYO	C5447	UR18650F	Cylindrical	SANYO
6RXVHF1	LATITUDE D630 ATG	January 21, 2008	SANYO	NT377	UR18650F	Cylindrical	SANYO
92YYLF1	PRECISION M6300	February 10, 2008	SANYO	C5447	UR18650F	Cylindrical	SANYO
9RN8MF1	LATITUDE D520	February 14, 2008	SANYO	TT710	UR18650F	Cylindrical	SANYO
DRN8MF1	LATITUDE D520	February 14, 2008	SANYO	TT710	UR18650F	Cylindrical	SANYO
JRN8MF1	LATITUDE D520	February 14, 2008	SANYO	TT710	UR18650F	Cylindrical	SANYO
FRN8MF1	LATITUDE D520	February 14, 2008	SANYO	TT710	UR18650F	Cylindrical	SANYO
FF2SQF1	PRECISION M6300	February 25, 2008	SANYO	C5447	UR18650F	Cylindrical	SANYO
8WZ5SF1	LATITUDE D630	March 5, 2008	SONY	KP428	US18650G8AC	Cylindrical	SONY
7WZ5SF1	LATITUDE D630	March 5, 2008	SONY	KP428	US18650G8AC	Cylindrical	SONY
H35V1G1	LATITUDE D630	April 17, 2008	SANYO	KP422	UR18650F	Cylindrical	SANYO
JT3K4G1	LATITUDE D530	April 25, 2008	SANYO	TT710	UR18650F	Cylindrical	SANYO
H88XDG1	PRECISION M6300	June 6, 2008	SANYO	C5447	UR18650F	Cylindrical	SANYO
FFRXLG1	LATITUDE D530	June 18, 2008	SANYO	TT710	UR18650F	Cylindrical	SANYO
5W71YG1	LATITUDE D530	August 3, 2008	SANYO	TT710	UR18650F	Cylindrical	SANYO
9W71YG1	LATITUDE D530	August 3, 2008	SANYO	TT710	UR18650F	Cylindrical	SANYO
1JB9NH1	LATITUDE D630	October 28, 2008	SANYO	KP422	UR18650F	Cylindrical	SANYO
2GLHRH1	LATITUDE E6500	November 30, 2008	PANASONIC	FU441	CGR18650EA	Cylindrical	PANASONIC
JW16XH1	LATITUDE D630	December 28, 2008	SANYO	NT377	UR18650F	Cylindrical	SANYO
3X16XH1	LATITUDE D630	December 28, 2008	SANYO	NT377	UR18650F	Cylindrical	SANYO

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Exhibit 14 - Laptop Purchases by the City of Palo Alto from 2004 through 2011

Finished Product Model	Laptop Part Number	Battery Pack Model Number	Number of cells	Battery Pack Manufacturer	Battery Cell Model Number	Battery Cell Manufacturer	Battery Type
Toshiba Tecra M11-S3440	PTME3U-01300Q	PA3788U-1BRS	6	Sanyo	3UR18650F-2-TBO3B	Sanyo	Cylindrical
Toshiba Portege R700-S1310	PT310U-01Q01Q	PA3832U-1BRS	6	Panasonic	NCR18650AB	Panasonic	Cylindrical
Toshiba Portege R700-S1310 Extended Capacity Battery	PT310U-01Q01Q	PA3833U-1BRS	9	Panasonic	NCR18650TC	Panasonic	Cylindrical
Toshiba R850-S8522	PT525U-05502U	PA3905U-1BRS	6	Sanyo	3UR18650ZTA-2-TBO28	Sanyo	Cylindrical
Toshiba Tecra M9-S5515	PTM91U-03501T	PA3588U-1BRS	6	Sanyo	3UR18650F-2TBO1U	Sanyo	Cylindrical
Toshiba Satellite M30 (Satellite M30-S309, Satellite M30-S3091, M30 Small Business Series)	PSM30U-0QKJ18 PSM30U-0QKJ19 PSM30U-0QKJ18S	PA3331U-BRS	6	SONY	US18650G	SONY	Cylindrical
Toshiba Portege M400-ST9113	PPM40U-1V700D	PA3191U-5BRS	6	SONY	US18650G7FB	SONY	Cylindrical
Toshiba Portege R700-S1312	PT310U-06502Y	PA3832U-1BRS	6	Panasonic	NCR18650AB	Panasonic	Cylindrical
Toshiba Portege R700-S1312 Extended Capacity Battery	PT310U-06502Y	PA3833U-1BRS	9	Panasonic	NCR18650TC	Panasonic	Cylindrical
Toshiba Portege R700-S1320	PT311U-00J00U	PA3832U-1BRS	6	Panasonic	NCR18650AB	Panasonic	Cylindrical
Toshiba Portege R700-S1320 Extended Capacity Battery	PT311U-00J00U	PA3833U-1BRS	9	Panasonic	NCR18650TC	Panasonic	Cylindrical
Toshiba Tecra A10-ST9010	PTSB3U-0FM00W	PA3588U-1BRS	6	Sanyo	3UR18650F-2TBO1U	Sanyo	Cylindrical
Toshiba Tecra R840-S8420	PT42GU-008001	PA3929U-1BRS	6	Sanyo	NCR18650AD	Sanyo	Cylindrical
Toshiba Tecra M2	PTM20U-002L27 PTM20U-004827 PTM20U-00CSR7	PA3356U-1BRS	6	SONY	US18650G	SONY	Cylindrical
Toshiba Tecra M6 (Tecra M6-EZ6611)	PTM60U-003001	PA3356U-2BRS	6	SONY	US18650G	SONY	Cylindrical
Toshiba Tecra M9-S5515 High Capacity Battery	PTM91U-03501T	PA3357U-3BRL	12	Sanyo	UR18650FJ	Sanyo	Cylindrical
Toshiba Tecra A10-ST9010 High Capacity Battery	PTSB3U-0FM00W	PA3357U-3BRL	12	Sanyo	UR18650FJ	Sanyo	Cylindrical

EXHIBIT 4

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IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION

CONFIDENTIAL – TO BE FILED UNDER SEAL
SUBJECT TO PROTECTIVE ORDER

IN RE: LITHIUM ION BATTERIES ANTITRUST LITIGATION THIS DOCUMENT RELATES TO: ALL INDIRECT PURCHASER ACTIONS	No. 13-MD-02420 YGR (DMR)

SUPPLEMENTAL EXPERT REPLY REPORT OF EDWARD E. LEAMER, PH.D.

November 21, 2017

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I. Introduction, Assignment, and Summary of Conclusions

1. I have been asked by counsel for the Plaintiffs in this case to respond to the Declaration of Dr. Laila Haider.[1]

2. In my Supplemental Report[2] in response to the "Order Denying Without Prejudice," I provided additional discussions and analyses that further support my conclusions from the first two reports:[3]

   a. Packer pass-through. I was able to obtain packer data which allowed me to estimate packer pass-through. Using additional data and regression analysis, I demonstrated that cell overcharges were completely passed on to prices of packs manufactured by non-Defendant packers. Since pass-through is a market-determined phenomenon, I also used Defendant data on prices of cells and the prices of packs which included these cells to study what might be called "market" pass-through, which is dictated by the competitive forces in the market for packs and cells;

   b. Additional Pass-through studies. I updated my pass-through analysis with several new third-party datasets for notebooks, camcorders, and power tools. In addition, I provided a summary of the pass-through results that show complete pass-through of cost changes to prices paid by consumers;

   c. Rebates, discounts and bundling. I explained that rebates, discounts and bundling may affect the prices of goods sold, but these pricing methods do not eliminate the need for firms to price products in a way that covers costs. Furthermore, I demonstrated using data sets that I had access to that rebates, discounts, and bundling do not affect the conclusions of complete pass-through derived from the regressions of

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[1] Declaration of Laila Haider, Ph.D., October 24, 2017 ("Haider Report").

[2] Supplemental Expert Report of Edward E. Leamer, Ph.D., September 26, 2017 ("Leamer Supplemental Report").

[3] Corrected Expert Report of Edward E. Leamer, Ph.D., February 2, 2016 ("Leamer Opening Report") and Expert Reply Report of Edward E. Leamer, Ph.D., August 23, 2016 ("Leamer Reply Report").

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net price on net cost, where net means adjusted for these retailing methods; and

d. Focal Points and Quality Competition. I explained that if prices of products are set at predetermined focal points, then quality competition replaces price competition, with firms competing to attract customers not with the prices they charge but with the quality of the products that they offer. Competition for customers assures that lower costs of features like batteries are used to improve the product quality rather than raise the profit margins of producers. I showed, using HP and Acer notebooks, that this really occurs. Using a set of laptops sold for between $900 and $1,000 between 2003 and 2008, I confirmed that the total costs of these laptops were quite constant, but the features including batteries improved substantially. This is clear evidence of pass-through of feature cost reductions via quality improvements. Moreover, since the total costs as well as prices remained about the same, the profit margins remained about the same, which means that all the savings from feature cost reductions were spent on feature improvement – thus 100% pass-through via quality improvement.

3. Dr. Haider has not presented any evidence or analysis that changes my conclusions. She has offered a lot of opinions, but hardly any support for them. Her discussions are irrelevant, speculative, and unconvincing. On more than one occasion, Dr. Haider simply restates the arguments presented by the previous defense expert, Ms. Guerin-Calvert.[4] I responded to these arguments in my earlier Reply Report, and Dr. Haider did not address my previous responses.

4. The lack of value in Dr. Haider's work is demonstrated by her nine exhibits.

- Exhibit 1 and Exhibit 2 only illustrate features of Best Buy prices for laptops. The meaning of these images is in the eye of the beholder. In Exhibit 1, I see evidence that the shelf life of this product was only four months, since that is when the price started to decline

[4] Expert Report of Margaret Guerin-Calvert, May 24, 2016 ("Guerin-Calvert Report").

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substantially. In Exhibit 2, I see a smattering of small changes and some big ones. The smattering of small changes allows pass-through of small changes in total costs. The big price reductions are symptoms of technological obsolescence of the product and the redesign that must have occurred after only about 6 months. A rapid rate of redesign allows rapid pass-through of costs via quality improvement.

- Dr. Haider uses Exhibit 1 to argue that my study of the shelf-life of Best Buy prices is misleading because I used the first price change to determine shelf-life when, at least in Exhibit 1, the first price change was temporary. Dr. Haider doesn't demonstrate how representative is her one example which seems surprising since representativeness is a focus of hers. I have redone my shelf-life analysis of all the Best Buy data, requiring the new price to persist at least seven days. This change does increase the shelf life from a mean of around 15 days to around 30 days. However, the bottom line seems all the more destructive of her fixed price hypothesis: Best Buy starts tinkering with the price 15 days after initial sales and makes "permanent" reductions after 30 days.

- Exhibit 3 and Exhibit 8 are pie charts that convey graphically the fact that the data I had available to analyze covered a small share of all cells sold to packers by Defendants and a small share of cells in finished products. Statistical accuracy comes from the number of observations not from the share of the population sampled. Therefore, I am not sure what meaning Dr. Haider thinks these pie charts have. She doesn't tell us. And she doesn't tell us what percent she believes is necessary for the studies to be useful.

- Exhibit 4 illustrates that the average of prices of similar packs sold to Dell by Dynapack and Samsung diverged after 2010. I discuss below that this is a misleadingly designed image, and it is at odds with the bulk of the rest of the data evidence.

- Exhibit 5, taken from the Moe Declaration, just displays some examples of product bundles offered by Best Buy. I have never suggested that Best Buy does not use bundles, and I don't know what to make of these examples. Dr. Haider doesn't tell us what is the point of this exhibit. She makes the argument "sales of bundled items were prevalent during the proposed class period." But if Exhibit 5 includes

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all bundles, it demonstrates the opposite – there were hundreds of products for sale at Best Buy but only a few bundles – 2 bundles in 2006, 6 in 2007, 3 in 2008, 4 in 2009 and 2 in 2010. I do not suppose that this is an inclusive list, but my point is only that this list doesn't say anything about prevalence of bundles. Also, Mr. Moe's quotation, which is prominently featured,[5] refers to bundles which include "low or negative-margin products with profitable items." Negative margin does not mean free, and this quotation clearly does not support Dr. Haider's apparent belief that some components are given away for free without regard for their cost (the zero pass-through hypothesis).

- Exhibit 6 is a whole page that adds nothing to what could be said in a sentence: My studies of pass-though use data on total cost. With few exceptions, firms have not provided battery costs separately from total costs. I reviewed all datasets and determined that Toshiba was the only adequate dataset for a pass-through analysis of battery costs specifically. The reason that firms do not routinely put the costs of individual components into their sales records is that profits and pricing are based on total costs.

- Exhibit 7 is only a re-estimation of my threshold pass-through regression with the enlarged data set from my Reply Report.

- Exhibit 9 is an altered version of my study of the Toshiba pass-through of battery costs. I explain below why this is irrelevant.

5. Dr. Haider's explanations of her work do not make it any more relevant:

a. With regards to packer pass-through studies, Dr. Haider erroneously takes the lack of statistical significance on the contemporaneous coefficients as evidence of no pass-through in the short-run, and no injury for some class members. For Dr. Haider, "short-run" means a price change in the same month as a cost change. Applying a relevant minimal definition of the short-run (particularly given the time to fabricate packs and products containing LIB cells) my analysis

[5] Haider Report, 61.

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uncovers positive and significant pass-through in all studies both in short-run and long-run. Moreover, her first month focus is a concern that affects at most only the first month of the 136 months of alleged battery over-pricing.

b. Also on the pass-through issue, Dr. Haider has not offered any meaningful criticism of my use of Defendant cell and pack prices to study "market" pass through. She seems not to understand that pass-through is a market phenomenon which allows one to study pass-through by comparing the prices in markets for components with the prices in markets for products that use those components.

c. Dr. Haider repeats Ms. Guerin-Calvert's observation that my pass-through studies are not based on a random sample of firms, and from this fact Ms. Guerin-Calvert asserted that my pass-through results are not representative of firms generally, while in the body of her report Dr. Haider makes the milder claim that "Dr. Leamer also does not attempt to establish that his data and results are representative of the varied economic conditions facing different packers, OEMs, distributors and for retailers, through which the proposed class members purchased the different finished products at issue…"[6] On the contrary, I have estimated pass-through for packers, and for OEMs, and for distributors, and retailers, and I found over and over again pass-through estimates that cluster around 100%, the very number that economic theory suggests is likely to occur in competitive settings. I would worry about non-representativeness if the pass-through estimates varied substantially between and within the categories, especially if there were many cases in which the data suggested convincingly that the pass-through rate is zero, thus leaving the customers unharmed. There are none of these cases.

d. Dr. Haider resurrects the idea from the Guerin-Calvert Report that it takes a random sample to be representative, and non-random "convenience" samples are never to be relied on.[7] This view is absurd.

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[6] Haider Report, 7.

[7] Haider Report, 42; Guerin-Calvert Report, 61.

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I cannot understand how a professionally trained and experienced economist would make this argument since professional economists every day make do with convenience samples, though they do not usually use the pejorative "convenience." In a published article, Dr. Haider herself has relied on a convenience sample. It is certainly the case that a random design is worthy scientific practice, but even random samples can be subject to bias issues, for example because of different rates of response. For instance, people might be more or less likely to respond to an internet poll based on their age, level of education, or other general factors. To turn these "random convenience" samples into representative samples, an analyst has to argue that the rate of nonresponse is small enough and the likely difference between non-responders and responders is also small enough that the sample is adequately representative of the population from which it was extracted. It takes wisdom and understanding to decide when a sample is representative and when it is not.

e. In the context of this case, it is impossible to obtain a random sample of firms to study pass-through (for example, I understand the court is not equally able to force every relevant company to respond), and the best approach is to study each and every data set that can be obtained, as I have done. Dr. Haider suggests there is no information in all this data, since these are not a random sample of firms. I categorically deny this. A nonrandom sample needs to be scrutinized for evidence of non-representativeness (bias), not thrown away altogether. Defendants' experts have apparently not uncovered any evidence of blatant or even mild non-representativeness, since none has been identified. The news in my estimates of pass-though is not that there is any great heterogeneity reflecting "the varied economic conditions facing the different packers, OEMs, distributors, and retailers"[8] but instead that there is a surprising sameness of the estimates, clustering around 100%.

f. With regards to discussions of rebate and discount effects, Dr. Haider ignores both the econometric theory that I discussed and the real-world evidence in my Supplemental Report. For estimating a pass-

[8] Haider Report, 7.

through regression, the econometric theory indicates that measurement error in the prices received (discounts) causes no bias while measurement error in the costs paid (instant rebates) biases the pass-through rate downward. Both kinds of error increase the standard error of the pass-through estimate. The point is that discounts and rebates may make the pass-through rate appear smaller than it actually is and make it more difficult to obtain statistically significant estimates. They do not create the appearance of pass-through that is not there. I confirmed this theoretical result with a study of three different data sets that included enough information which allowed me to estimate pass-through both with and without adjustments for rebates and discounts. After summarizing my argument,[9] Dr. Haider offers her familiar comment: she says it's not enough: "I explain below that Dr. Leamer ignores substantial rebates and discounts to intermediaries and proposed class members and he provides no workable methodology to account for them."[10] The key point is that the econometric theory that I discussed applies to each and every data set, available or not. I have obviously provided a workable statistical methodology that can be applied to any available data set. What Dr. Haider must mean is that I have not provided a workable methodology for obtaining enough data sets to satisfy her apparently unquenchable thirst for more data. Here, I do address Dr. Haider's comments on not using rebates and discounts data from SED and Dell by including that data in my analysis. The additional data serves to further support my conclusions.

g. The bundling issue fits well with the spirit of inquiry that Dr. Haider has applied to her task. Most business records do not keep track of the separate costs of all the items in a bundle but track instead only total costs. This makes it impossible to run a pass-through regression that explains price as a function of the costs of all the separate parts of the bundle. This feature of the business records is what allows Defendants' experts to claim that I have not refuted the possibility that some parts of the bundle are given away for free, and therefore have zero pass-

[9] Haider Report, 53-54.

[10] Haider Report, 54.

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through rates. Dr. Haider's summary on this point may sound familiar: "Dr. Leamer's analysis of bundled sales is flawed and he provides no workable methodology to account for them."[11] I see this differently. Economic theory does not allow profit-maximizing firms actually to give away anything for free, but only to offer items for free to get customers to pay more for some other item. In support of her hypothesis that bundling involves items for free Dr. Haider quotes Mr. Daniel Moe of Best Buy, which is actually a great example of how firms design bundles, with nothing given away for free:

> For example, he testified that notebook PCs were "most often sold at a negative gross margin," and to make up for using them as a loss-leader "[a]ssociates were expected to 'build the basket'—i.e., bundle such low or negative-margin products with profitable items such as a Geek Squad service, extended warranty, software, or accessories."[12]

First of all, this is clearly not giving away the notebook for free, nor is it zero pass-through as if the cost of the notebook didn't affect its discounted price. It's a loss-leader designed to sell the other items in the bundle. The reason bundles are created is that the price elasticity of the bundle is expected to be less than the price elasticity of the individual components, making discounting of a bundle a better retail strategy than discounting the individual components. It's not charitable giving.

"There is no such thing as a free lunch" is a familiar way of making the point. In addition to the economic theory, I have offered a large number of pass-through studies of both bundles and individual items, none supportive of the zero pass-through hypothesis. Given the body of theory and empirical evidence refuting the zero pass-through

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[11] Haider Report, 54

[12] Haider Report, 61.

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hypothesis, it seems to me about time to see some evidence, not just another hypothetical. Lastly, Dr. Haider's claim that bundling was prevalent is not supported by actual analysis in her report.

h. For Dr. Haider, focal point prices serve the same rhetorical purpose: they allow her to raise the hypothesis of zero pass-through. The theoretical counter-argument is that firms have to price products in a way that covers costs, and consequently costs and prices are necessarily related even if the prices are fixed: better products that are costlier to produce are sold at higher focal point prices and, over time, as costs of components vary, the product quality at any fixed focal point will move opposite to the component cost, keeping total cost constant. Dr. Haider seems not to understand how quality competition replaces price competition when prices are fixed at focal points. She doesn't offer any comments beyond what was previously offered by Ms. Guerin-Calvert. I will revisit the main ideas below.

i. In addition, Dr. Haider provides a misleading modification of my overcharge regressions to argue that Simplo and Dynapack did not suffer injury. Dr. Haider makes the same mistakes as the previous Defense expert and does not respond to my past comments in this regard, as I explain below.

j. In another one of her "not enough data complaints," Dr. Haider states that my pass-through regressions for packer Simplo USA to Dell only includes replacement batteries and that I have not studied pass-through of packs from Simplo Taiwan. Dr. Haider concludes: "Further, Dr. Leamer does not analyze pass-through of any alleged cell overcharge from Simplo Taiwan to its distribution subsidiary in the U.S. As a result, his work is incomplete and also not informative about pass-through of an alleged cell overcharge for third-party packer and OEM/ODM combinations that were in different distribution chains."[13] My regression of Simplo USA studies pass-through of cell prices charged to Simplo worldwide (including Simplo Taiwan) on pack prices charged by Simplo USA to Dell. With regards to it containing

[13] Haider Report, 43.

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only replacement packs, I have been able to obtain data for Simplo Taiwan's sales of packs that went directly into notebooks manufactured by various OEMs. I report below a pass-through regression using that data. No surprise, the results are supportive of 100% pass-through of the overcharge.

k. Dr. Haider is critical of my hedonic regression, which explains prices and costs as a function of the features of the laptops. My only use of these regressions was to suggest what would go into product design, balancing costs of components and the value of added features. Dr. Haider's comments seem aimed at some more important role for these results than they are meant to serve. Best to keep in mind that product designers know the costs of all the features and do not have to rely on imperfect regressions to infer them. Designers probably do have to rely on something like a regression of price on the features to get a sense of what their product design might sell for.

l. Finally, her comments on my past analysis of battery costs and small cost pass-through are misleading. Regarding small cost pass-through, Dr. Haider revisits a regression from my Reply Report showing that even small cost changes are passed on with new data from my Supplemental Report. She points to the imprecisely measured small negative estimated immediate pass-through effect as an indication that such small cost changes do not impact product prices. She neglects to check or report what pass-through there is in the months after that. Within two months, the estimated pass-through is positive and statistically significant. Regarding battery costs, Dr. Haider modified a regression I presented in my earlier reports testing whether battery cost pass-through is different pass-through on other costs. Dr. Haider introduced costs of two other components and argued that the results show no pass-through on battery costs. However, a more careful look at the data shows that the results are actually compatible with the conclusion of 100% and are not compatible with 0% pass-through of battery costs.

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II. Dr. Haider's Claim That Focal Point Pricing Prevents Pass-Through Is Wrong

A. Firms Pass-Through Cost Changes Regardless of Focal Points

6. Dr. Haider has written (as the title of her report's Section V.C): "Dr. Leamer's Quality Adjustment Hypothesis is Neither Tested Nor Rooted in the Economic Facts; He Fails to Propose Any Methodology to Demonstrate a Quality Reduction in the Actual World."[14] All three parts of this statement are false. Let's begin with whether quality adjustment is "rooted in economic facts," which I interpret to mean economic theory.

7. A basic tenet of economics is that firms act to maximize profits, given the competitive circumstances they face and that to do so they set their prices as an increasing function of their costs. In my original Report in this case, I explained that pass-through of costs occurs in essentially every realistic model of competition:

> Standard microeconomic theory shows that the only situations in which exactly zero pass-through would be expected in the face of a cost increase are if either a) an entire industry (not individual producers within the market), faced a perfectly elastic (*i.e.*, horizontal) demand curve; or b) the market supply curve is perfectly inelastic (*i.e.*, vertical) at the margin. The demand curve for LIB batteries which have no viable substitutes in many applications is surely not perfectly elastic. A perfectly inelastic supply curve is also highly unlikely because even with manufacturing capacity constraints output can be increased with multiple shifts and more rapid operations. Therefore, with the zero pass-through scenario a highly unlikely outcome for theoretical reasons, we should be regarding as highly probable that at least a portion of increased LIB costs were passed through to computer

[14] Haider Report, 30.

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and consumer electronic equipment prices. There is consequently some harm to consumers of these products that would be a consequence of a successful collusion that raised LIB prices.[15]

8. The usual profit maximization premise can be used both to explain how firms use cost reductions to support lower prices and also how firms use cost reductions to support quality improvements. The traditional markup rule is derived from three assumptions (1) profit maximization, (2) constant marginal costs c, and (3) a demand curve Q(p) which expresses the quantity sold as a function of the price charged.[16] Profits then are revenue (Q, the quantity sold, times p, the price) minus total costs (quantity times c, the marginal cost),

$$\pi = pQ(p) - cQ(p).$$

Maximization of profit implies a (pass-through) markup formula:

$$p = c/\left(1 + \frac{1}{\eta}\right)$$

where η is the elasticity of demand, a negative number.[17] This pass-through rate is 100% if the demand is infinitely elastic ($\eta = -\infty$), which is the case for a seller in a perfectly competitive industry. Otherwise the pass-through rate is greater than 100%. (I discussed in my original Report common situations in which over-shifting of costs, i.e., greater than 100% pass-through occurs.[18])

9. It is not stated—but it is implicitly assumed—that this markup rule applies to a product with a predetermined design. The same approach can be used to study

[15] Leamer Opening Report, 65-66.

[16] In both the but-for and the actual world, OEMs would face the same competitive pressures to improve productivity and lower fixed costs.

[17] $\eta = \frac{Q'}{Q}p$

[18] Leamer Opening Report 64-67.

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the logic underlying quality competition applicable to fixed focal point prices with variable product quality. Using v (for value) to represent quality, we can write the profit function as

$$\pi = pQ(v) - cvQ(v),$$

where $Q(v)$ is the quantity sold as function of quality v, c is the marginal cost of a product with quality $v = 1$ and cv is the marginal cost of an extra unit of output with quality v. Maximization of profits then determines the product quality:

$$v = \frac{p}{c} / \left(1 + \frac{1}{\beta}\right)$$

where β is the elasticity of quantity sold with respect to product quality, a positive number.[19]

10. According to this rule, the full reduction in cost is passed on in the form of improved quality, $v = \frac{p}{c}$, when the elasticity of sales with respect to quality is infinite. This result is analogous to the case of 100% pass-through of costs into prices when the price is variable but the quality is not. If the elasticity of demand is less, the production costs as a share of the sales price is less, $cv/p < 1$, which leaves some profit for the seller. This is the case of positive but not 100% pass-through.

11. My point is that there is nothing essentially different about price competition and quality competition in terms of a damage assessment. In the 100% pass-through case, the same formula applies to both forms of competition, namely $cv = p$. When product quality v in this formula is fixed, falling costs lead to falling prices. When price is fixed, this same formula implies that falling costs lead to improved quality. In both cases the damages come from the fact that

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[19] $\beta = \frac{Q\prime}{Q} v$

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customers are paying too much for the quality of product they purchased. In the but-for world with price competition, customers would have been charged less for the product they purchased. In the but-for world with quality competition, customers would have paid the same amount, but would have purchased a better-quality product in the amount that the cost reduction could support. In the case of 100% pass-through, the monetized value of the damages are exactly the same, namely the reduction in cost in the but-for world.

1. The Monetized Damages Are the Same Whether One Purchases at Focal Points or Not

12. Dr. Haider claims that there are two kinds of purchasers–those who purchased at focal points and those who did not—and that these two groups would have "sustained harm in different ways."[20] Thus, according to Dr. Haider, "This suggests that separate inquiries are required for the assessment of injury for those different sets of proposed class members."[21] I offered the opinion in my deposition that the quality landscape created by quality competition at the focal points is likely to spill over to the rest of the prices, which means that there is a quality part to the damages at every price. But most importantly for the 100% pass-through case, there is one formula, $cv = p$, which governs the relationship between cost, quality and price whether p is variable or quality is variable. The monetized damages are then the same for both types of harm, measured by the increased cost, c. There is the possibility of course that pass-through is different at focal points than at non-focal points. To explore this idea, I have compared costs and prices of third-party entities sold at prices ending in $9. Using monthly data, I estimated a "pass-though" equation in each month that predicts the focal point price as a function of the measured cost.

13. Figure 1 and Figure 2 below illustrate the estimated "pass-through" coefficients on a month-by-month basis for MEI notebooks and camcorders. I estimate

[20] Haider Report, 30.

[21] Haider Report, 30.

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similar equations for a number of other entities, for which transactional data of matched prices and costs were provided, and summarize the results in Figure 3. These pass-through estimates are clustered around 100% and confirm that there is generally a one-for-one difference in total costs corresponding with any difference in focal point prices for notebooks, camcorders, and power tools (e.g., if two focal points ending in 9 differ by $10, the corresponding costs also differ by $10).

Figure 1: Pass-Through of Costs to Focal Point Prices

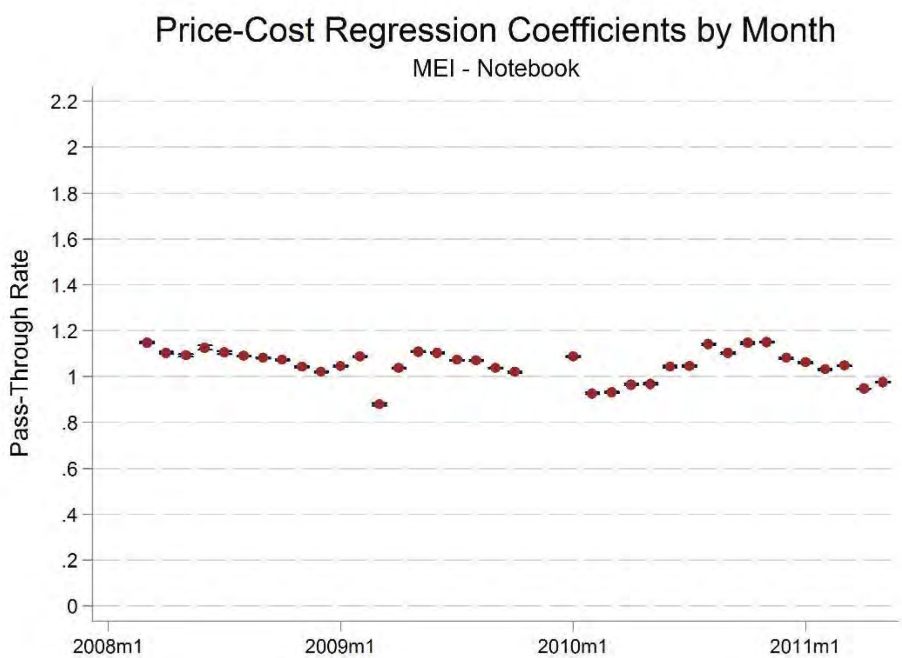

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Figure 2: Pass-Through of Costs to Focal Point Prices

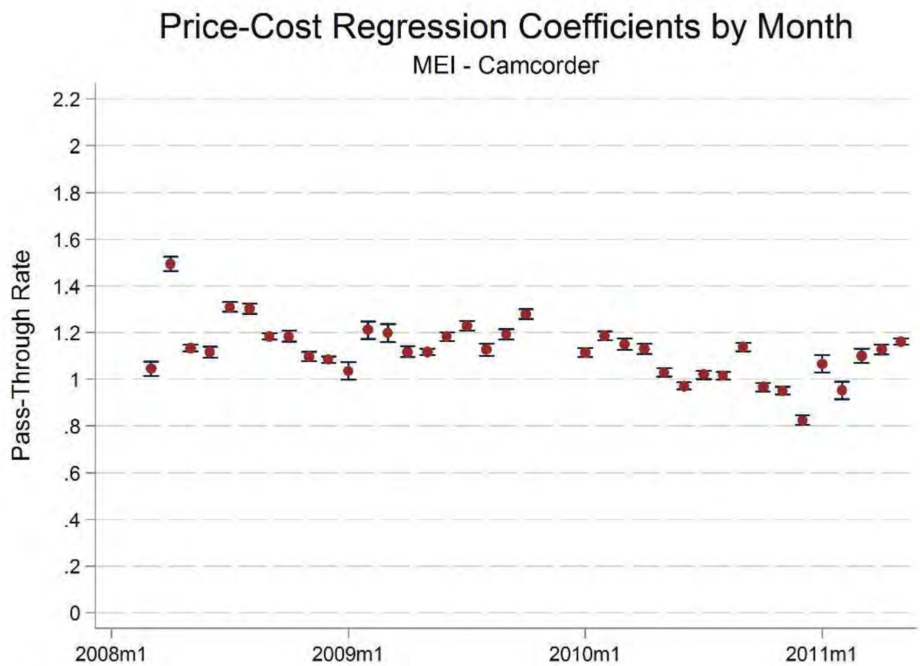

Figure 3

Summary of Focal Point Pass-Through Estimates
Amazon, Brandsmart, CompUSA, CompuCom, Cornwell, MEI, Newegg, NFM, PC Connection, SED International

Dep. Var.: Focal Point Price (Unit Price ending in $9)
Ind. Var.: Unit Cost

	Notebooks		Camcorders		Power Tools	
Pass-Through Rate	Number of Regressions	Sales-Weighted Share of Regressions	Number of Regressions	Sales-Weighted Share of Regressions	Number of Regressions	Sales-Weighted Share of Regressions
(1)	(2)	(3)	(4)	(5)	(6)	(7)
		(Percent)		(Percent)		(Percent)
Statistically greater than 100%	312	72.1	188	89.8	3	54.1
Statistically indistinguishable from 100%	123	3.0	19	7.7	2	29.8
Statistically greater than 0% and less then 100%	207	24.9	8	2.0	2	16.1
Statistically less then 100% and indistinguishable from 0%	0	0.0	2	0.3	0	0.0
Statistically indistinguishable from 0% and 100%	1	0.0	1	0.2	0	0.0
Total:	**643**		**218**		**7**	

Notes: (1) Separate regressions by month, product type, and company.
(2) The statistical comparison to 0% and 100% was performed using the following rules:
Statistically greater than 100% - 100% < Lower bound < Upper bound
Statistically indistinguishable from 100% - 0% < Lower bound < 100% < Upper bound
Statistically greater than 0% and less then 100% - 0% < Lower bound < Upper bound < 100%
Statistically less then 100% and indistinguishable from 0% - Lower bound < 0% < Upper bound < 100%
Statistically indistinguishable from 0% and 100% - Lower bound < 0% < 100% < Upper bound

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B. Quality Improves as Costs Decline if the Price is Held Constant

14. Next, I will address Dr. Haider's claim: "He Fails to Propose Any Methodology to Demonstrate a Quality Reduction in the Actual World."[22] In my Supplemental Report, to demonstrate quality improvements that are evident in laptops that sold for about the same price, I selected a subset of HP laptops that sold for between $900 and $1000 between 2003 and 2008. The total costs of production of these laptops are fairly constant. If the costs of the features as well as the total costs were constant over time, one would expect little change in the laptop features, but Figure 21 of my report showed large improvements in these laptop's features including hard disk size, screen size, RAM size, battery pack capacity, cache size, number of bits, number of cores, and number of threads.[23] This can be explained if the costs of the features were declining. To find the "quality reduction in the actual world" associated with cost increases, you just need to run the clock backward, beginning in 2008 when the costs of the features were low and ending up in 2003 when the costs of the features were high. These features' cost increases are associated with substantial declines in quality.

15. A similar process occurs in other products, such as power tools. Manufacturers introduce newer, better quality models that replace older ones at the same price point. That is to say, instead of choosing to reduce product prices in response to declining costs, they redesign products and choose to offer better quality at the same or similar prices.

16. Figure 4 and Figure 5 show an example of such quality improvements using the two top selling hammer drill models in the Black and Decker data.[24] The two charts show quarterly sales volume and price for these two models. The

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[22] Haider Report, 30.

[23] Leamer Supplemental Report, 50-51.

[24] Data deficiencies for power tools do not allow for a comprehensive analysis. Datasets, e.g., Fry's and Home Depot, often did not provide product model codes or provided them inconsistently. Additionally, none of the datasets contained detailed quality characteristics.

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DCD970KL model was introduced around the beginning of 2009 at about the same time as the older model DC927KL was discontinued. It was also introduced at roughly the same price–$300. The price of DC927KL dropped briefly for a couple of quarters as its' sales phased out. The newer model, DCD970KL, appears to have picked up exactly where the other one left off, except it had significant improvements in terms of product quality.

17. Both models are three-speed hammer drills with 18-Volt lithium-ion battery packs, half-inch chuck capacity and 22 clutch settings. However, DC927KL uses 2.0Ah batteries, while the newer DCD970KL comes with higher battery capacity of 2.4Ah.[25] The new model also had higher maximum power out (450 vs. 425 UWO); higher maximum speed (2,000 vs. 1,800 RPM) and higher maximum pounding power (34,000 vs. 30,600 BPM).[26] Overall, the newer model is a definite improvement over its older counterpart, yet it sold at about the same price.

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[25] "Dewalt DC927KL 18V 13mm Cordless 3 Speed Combi Drill," TOOLSTOP, http://www.toolstop.co.uk/dewalt-dc927kl-18v-13mm-cordless-3-speed-combi-drill-2-batteries-p6628; "Dewalt 1/2-in 18-Volt Lithirum Ion (Li-ion) Variable Speed Cordless Hammer Drill," Lowe's, https://www.lowes.com/pd/DEWALT-1-2-in-18-Volt-Lithium-Ion-Li-ion-Variable-Speed-Cordless-Hammer-Drill/3005497.

[26] "DeWalt DC927KL 18V Hammer Drill Kit," Coastal Tool, http://www.coastaltool.com/a/dewalt/dc927kl.htm;"DeWalt DCD970KL 18V XRP Li-Ion Hammer Drill-Driver Kit," Costal Tool, http://www.coastaltool.com/a/dewalt/dcd970kl.htm.

Figure 4

[redacted]

Figure 5

[redacted]

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C. Firms Have Ample Opportunities to Design Products Suited for Selling at Focal Points

18. How is it that firms are able to design products in a way that keeps costs constant at each of the focal points? The answer, which I demonstrated in my Reply Report, is that there are ample design opportunities which in combination allow the total costs to vary in small increments. The words "in combination" are critical and need to be understood. The total cost of a basket of groceries can be increased from $100 to $101 if you remove an item that costs $10 and replace it with one that costs $11.

19. One available data source, Toshiba notebook component cost data, demonstrates how firms designing products have access to and utilize a wide array of components and qualities at a range of costs.[27] An excerpt from this data is shown in Appendix A. The table, obtained directly from Toshiba's production, shows the costs related to the design of a Toshiba notebook model (PSAD6-00S00D) produced in 2006Q4 and 2007Q1. There are over 30 components listed, broken down into categories ("Architectural Costs," "Additional Costs," and "Key Parts"). Each category is also broken down into material and non-material costs. The items listed include inexpensive components, costing as little as $0.50, a much smaller contribution to total cost than the battery. In this example, there are 19 components for which the cost is less than the battery cost. These components include the audio chip, keyboard, touch pad, PCMCA, and others.

20. If manufacturers were not attuned to the cost and quality of the components, as the Defendants seem to suggest, what would be the purpose of tracking the costs down to such small levels? The purpose, as I have described previously, is to keep up with the competition and rapidly changing technology. Manufacturers account for all types of costs in designing the products and select these components to create products that are competitive enough and allow them to meet their product margin targets.

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[27] TSB-LIB-00082465_FT_06.23.2015.

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D. Dr. Haider Presents a Highly Misleading Characterization of My Evidence Regarding Quality Response to Falling Prices

21. I have offered evidence that cost reductions drive quality improvements for products sold at focal points. My argument has four parts. First, I explain theoretically that pass-through is a consequence of firms seeking profits but constrained by the competitive pressures. When prices are set at fixed focal points, this competitive pressure applies to product quality. Secondly, I have provided lists of product features and corresponding costs that product designers could choose from. This reveals ample opportunity for combinations of design changes to add up to small changes in total costs, thus allowing small changes in costs to be passed on to buyers of the product. Third is my study of the product features of HP and Acer laptops that sold for about the same prices over a five-year period, clearly demonstrating product quality improvements in the laptops which were sold for the same prices over time. Fourth, I have used Best Buy data to show the remarkably short shelf lives of the products they offer – generally less than four months for notebooks and 13 months for camcorders.[28] That means that the pace of redesign is quite rapid. Altogether, this means in the but-for world in which battery prices were lower, all or almost all buyers of products at focal points would be getting a better product for the same price.

22. The hedonic equations that I offered in my Supplemental Report are only for the second part of the argument–demonstrating the opportunities for design changes while keeping total costs constant.[29]

23. Dr. Haider offers a list of comments, none of which address my conclusions from this analysis.[30]

> In sum, despite Dr. Leamer's repeated assertions of quality reductions (or a slowdown in improvements)

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[28] Leamer Supplemental Report, 43.

[29] Leamer Supplemental Report, 55.

[30] Haider Report, 35-37.

> relative to the but-for world, he presents no evidence that suggests such quality reductions occurred in response to changes in cell costs. Moreover, he makes no attempt to assess what kind of quality adjustments, if any, for the finished products at issue could result from the alleged cell overcharge. As a result, he proposes no methodology to assist the fact finder with this inquiry.[31]

24. To this point I reply: the best measure of the quality impact is the cost impact, i.e., the overcharge.

25. As I explained in my Report, the hedonic analysis demonstrates the tools available to manufacturers for redesigning the product without various qualities of features and pass-on costs changes even if total costs and prices stay the same.[32] I explained that the data limitations may produce counterintuitive coefficient estimates, and it is not possible to account for all product features. The main purpose of this analysis was to demonstrate that costs and prices are almost entirely determined by the several quality characteristics used in the regression, which suggests that manufacturers can substitute one quality for another to maintain fixed costs and prices.[33] Dr. Haider did not criticize this basic argument.

26. In addition, I demonstrated how quality of features increased for the finished products with stable costs and prices. This is evidence of quality substitution in product design. Dr. Haider did not comment on this fundamental evidence either.

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[31] Haider Report, 32.

[32] Leamer Supplemental Report, 55.

[33] Leamer Supplemental Report, 55. Also, I note that the omission of 3 months in the middle of the two periods analyzed was not accidental. The purpose was to study two disjoint periods with sales of distinct items to compare cost and price decreases of individual components.

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E. Dr. Haider's Comments on My Best Buy Focal Point Analysis Are Irrelevant

27. Dr. Haider offered a few comments with regards to the analysis of Best Buy prices. Dr. Haider used the Best Buy sales data to argue that initial prices of notebooks "generally changed by amounts considerably larger than Dr. Leamer's alleged cell overcharge."[34] This is another irrelevant observation since the overcharges on battery costs are embedded into both small and large total cost declines. With rapidly changing technology and declines in various component costs, it is not surprising that the magnitude of total price declines are relatively large. Product turnover occurs so rapidly that the redesigned products will quickly reflect component cost changes.

28. In addition, Dr. Haider raises the issue that my analysis of focal point shelf life includes price cuts that were only temporary in nature. In Exhibit 1, she presents an example of a product sold in one Best Buy store which experienced its first price decline 16 days after first sale, but the price reverted back to the initial price after a single day.[35] This is just one (non-random) example. Dr. Haider did not analyze whether the picture is materially affected by these temporary price cuts. As I show below, they are not. In Figure 6, I re-compute the distribution of focal point shelf life for Best Buy notebooks now requiring that the initial price cut last at least seven consecutive days. The median focal point shelf life is around 30 days before the first price cut that lasted at least seven consecutive days. This picture should be compared with Figure 19 in my Supplemental Report,[36] which had median time to first price cut under 30 days. In other words, this concern about the temporary price cuts has some impact on my figure, but it still leaves the shelf life of Best-Buy price quite brief.

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[34] Haider Report, 28.

[35] Haider Report, 27.

[36] Leamer Supplemental Report, 46.

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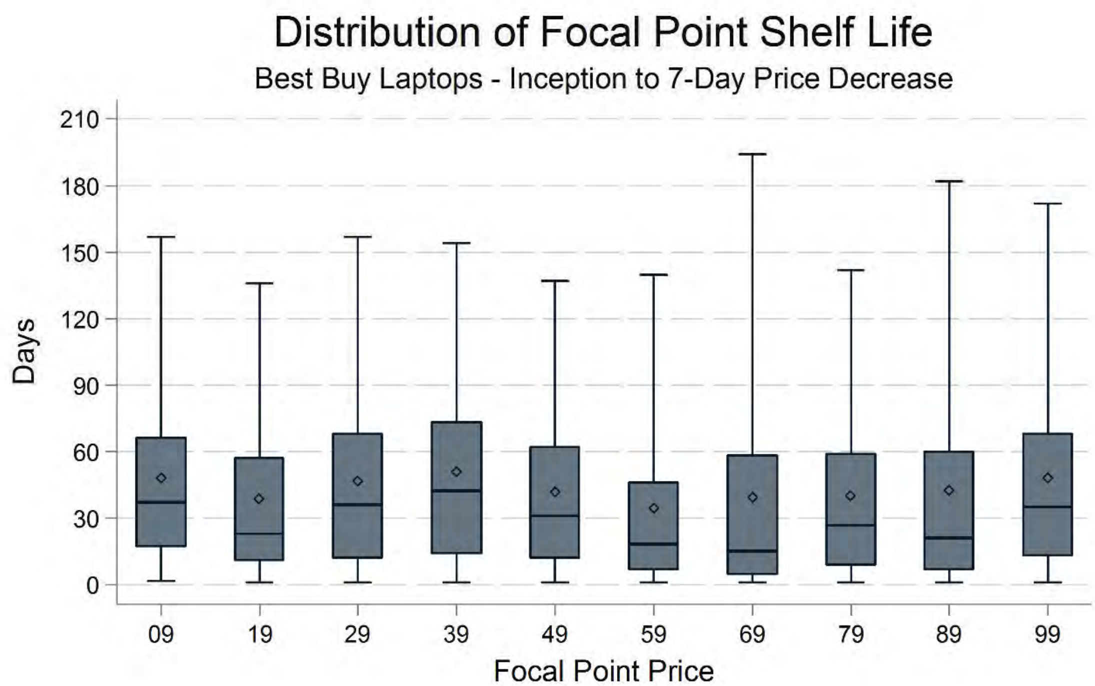
Figure 6: Focal Point Shelf Life Before First 7-Day Price Cut



Note: Shelf life is defined as the number of days from the first sale to the earlier of the last sale or first sale at a lower price which lasts for for at least 7 consecutive days.
Focal point prices are prices which end in $9, e.g. $409 or $399.
Source: Best Buy Transaction Data

III. Dr. Haider's Data Representativeness Critique Is Specious

A. Opinions Using Available Data Are Common Practice When Random Sampling Is Not Viable

29. Dr. Haider claims that I have "no reliable basis to assume that the small subsets of data [relied] upon provide representative samples such that they can be used to draw conclusions related to pass-through for the numerous intermediaries [and] all or virtually all members of the proposed class."[37] Dr. Haider raises two concerns regarding the sample of data upon which I rely to estimate economic pass-through. First, she says my data constitute a "convenience sample" and claims that "[i]t is not a generally accepted scientific practice to rely on a

[37] Haider Report, 12.

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convenience sample and simply assume that the data are representative of an entire population."[38] Second, she claims, by way of citation, that my "conclusions rely on a technique of non-random sampling, which 'is prone to bias and influences that are beyond [one's] control…meaning that subsequent generalizations are likely to be at best flawed.'"[39]

30. Random sampling is not an option in this case nor it is necessary to draw useful conclusions about pass-through. I tried to incorporate all the available data that was usable and analyzed a huge amount of data from the major companies in the distribution chain including two major non-Defendant packers. One perfectly legitimate approach would have been to combine all firms' data at each level into a single regression in order to maximize the power of the data. This would have required assuming similarity of the firms at each level; a reasonable assumption given these markets, for reasons I have stated. However, in order to respect the possibility that, contrary to expectations, competing firms might differ materially in their pass-through rates, I have run regressions separately for each firm. If zero pass-through were a fact at any of these firms, my regressions would reveal it.

31. Thus, the repeated finding of approximately 100% pass-through across all these separate regressions conveys a great deal of information about pass-through generally. While random sampling provides certain statistical advantages, most studies in economics rely on nonexperimental "observational" data and not randomized experiments. Even in the context of the economic analysis of pass-through, there are dozens of papers that rely upon non-random sampling.[40]

[38] Haider Report, 42.

[39] Haider Report, 42, citing "Mark N.K. Saunders, Adrian Thronhill, and Philip Lewis, "Research Methods for Business Students," Fifth Edition., Pearson, 2009, 241."

[40] *See e.g.*, Maria Arbatskaya and Michael R. Baye, "Are prices 'sticky' online? Market structure effects and asymmetric responses to cost shocks in online mortgage markets," *International Journal of Industrial Organization,* 22 no. 10 (December 2004) – Collected data from a non-random sample of 92 mortgage lenders of conventional 30-year fixed mortgages to measure pass-through of cost increases; Timothy J. Besley and Harvey S. Rosen, "Sales Taxes and Prices: An Empirical Analysis," *National Tax Journal,* 52 no. 2 (June 1999)

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32. Moreover, random samples are a goal, not a reality. Even randomly designed samples suffer from both nonresponse bias and response bias.[41] Whether any sample is representative of the population from which it is drawn is then a judgement call about the likely response bias and nonresponse bias which is something that depends on the circumstances. If we followed Dr. Haider's advice, we would not be allowed to make that judgement, and thus not allowed to use any data, ever.

33. Dr. Haider gives no reason to believe the sample of firms that I have studied is not representative of the larger population of firms. I have explained that pass-through is largely determined by the markets for components and the markets for final products, which makes all firms operating in the same markets behave similarly with regard to pass-through. This creates a presumption in favor of representativeness for the set of firms that I have studied. If they are non-representative, they may be biased in either direction: greater pass-through or lower pass-through. Dr. Haider has presented no evidence to demonstrate whether or how my data sample is in any way biased—her argument is entirely

– Examined pass-through of sales tax increases to the prices of certain commodities. The authors non-randomly selected 12 commodities from 155 cities from a broader set of data. These commodities and cities were chosen because their data were the only ones that existed over a specific period of time; Sophia Delipalla and Owen O'Donnel, "Estimating tax incidence, market power and market conduct: The European cigarette industry," *International Journal of Industrial Organization,* 19 no. 6 (May 2001) – Examined pass-through of tax increases to the prices of cigarettes. The authors collected price data from 12 member countries of the EU and elected only to use prices for the most popular cigarette categories; Donald S. Kenkel, "Are Alcohol Tax Hikes Fully Passed Through to Prices? Evidence from Alaska," *American Economic Review,* 95 no. 2 (May 2005) – Analyzed pass-through of tax increases to the price of alcohol. The author collected through telephone surveys of Alaskan establishments licensed to serve alcohol. The data were comprised only of those individuals who responded to the phone survey; Sergio Meza and K. Sudhir, "Pass-through timing," *Quantitative Marketing and Economics,* 4 no. 4 (December 2006) – Examined variation of retail pass-through rates over time. The authors rely upon data collected from a single grocery store chain in the Chicago area. The data sample was selected due to its public availability; Douglas J. Young and Agnieszka Bielinska-Kwapisz, "Alcohol Taxes and Beverage Prices," *National Tax Journal,* LV no. 1 (March 2002) - Examined the pass-through of tax increases to retail prices of alcohol. The authors rely on data collected from a survey of retail prices for a narrowly specific set of beverages, specifically the prices of a six pack of Budweiser or Miller Lite in 12 oz. containers, a 750 ml bottle of J&B Scotch, and a 1.5 liter bottle of Gallo or Livingston Cellars Chablis. This sample was used to draw conclusions on the broader market for alcoholic beverages.

[41] Nonresponse bias occurs when the responders are different from the non-responders. Response bias occurs when the responders provide biased information about themselves.

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speculative. Furthermore, the literature Dr. Haider cites is taken out of context and is not reflective of the manner in which my data were collected. For instance, one of the excerpts she quotes describe convenience sampling within the context of a specific type of non-random sampling procedures such as haphazardly interviewing people at a shopping center due to the relative ease of accessing a large group of people.[42] My data were not sampled in this manner.

34. Dr. Haider's stated views regarding the general scientific acceptability of convenience sampling appear to be contradicted by her own scholarly research. For example, in a 2005 paper published in the Journal of the European Economic Association, Dr. Haider conducted an econometric analysis which relied upon a non-random, convenience sample of only nine Western European countries to measure the impact of various demographic variables on changes in individuals' political views over time. She then used the results of her analysis to draw conclusions related to the population of Europe as a whole.[43]

35. Additionally, in her deposition Dr. Haider was unable to answer a number of questions regarding what constitutes an adequate sample in this type of case. She does not know if there are any indirect purchaser cases that used what she would believe to be a representative sample, or in this specific case, the percent of total cylindrical cells in finished products I would have to analyze to achieve what she would constitute as a representative sample.[44] Dr. Haider said that she does not know if it is even possible to get a random sample in this case.[45]

36. In her report, Dr. Haider critiques the sample size of cylindrical cells in Toshiba Notebook PCs, but in her deposition she brings up an example of a survey that uses what she thinks is "a 1 percent sample," but fits her view as

[42] Mark N.K. Saunders, Adrian Thronhill, and Philip Lewis, *Research Methods for Business Students*, (Essex: Pearson, 2009).

[43] Edlund, Lena, Laila Haider, and Rohini Pande, "Unmarried Parenthood and Redistributive Politics: Evidence from Europe." *Journal of the European Economic Association* 3, no.1 (March 2005): 95-119.

[44] Deposition of Laila Haider, Ph.D., November 14, 2017 ("Haider Deposition"), at 79:14-24, 305:12-307:24.

[45] Haider Deposition, at 84:13-20.

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representative.[46] Further, she was unable to identify a single retailer that I should have analyzed, but didn't.[47] Despite this, Dr. Haider states that "it's inappropriate to extrapolate those findings to everyone – to really a – a vast majority of sales that he did not study."[48] Yet, in her own analysis (such as in her 2005 Journal of the European Economic Association article), she uses the very tactic of extrapolating findings from a non-random sample.

37. In a number of examples, Dr. Haider criticizes the sample that I use in my analysis, but does nothing to show that the sample is not representative and provided no reason to suspect it is not representative. For instance, Dr. Haider has not done any checks or analyses to show that my analysis of packs sold by Simplo USA to Dell is not representative of other pack sales.[49]

B. Dr. Haider's Critique of Packer Pass-Through Data Is Speculative and Unsubstantiated

38. I understand that the data on third-party packers is challenging to obtain because they are primarily non-US firms. Nonetheless, I was provided with data on prices charged by two of the major third-party packers for batteries sold to two major OEMs. As Dr. Haider's own exhibit shows, Simplo and Dynapack were the largest and third largest (respectively) third-party packers purchasing cells from the Defendants.[50] Also, as Dr. Haider's own exhibit shows, Dell and Acer were the top 2 purchasers of packs from the Defendants.[51] Also, according to OEM's battery procurement data, Simplo and Dynapack supplied a third of Dell batteries, and Simplo alone supplied over 96 percent of Acer batteries.

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[46] Haider Report, Exhibit 8; Haider Deposition, at 87:17-88:4.

[47] Haider Deposition, at 143:19-23.

[48] Haider Deposition, at 71:16-20.

[49] Haider Deposition, at 156:24-158:14.

[50] Haider Report, 117, Table D-5.

[51] Haider Report, 118, Table D-6.

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39. By Dr. Haider's own admission, the issue is not the volume of the data, it's the representativeness of this sample and its usefulness for drawing conclusions about pass-through.[52] As I discussed above, Dr. Haider is wrong if she thinks that this sample cannot be used to draw legitimate inferences about pass-through, and she did not provide any evidence to support that view. She also did not comment on my opinions in the previous report addressing this issue.[53]

40. Dr. Haider's discussion of the effect of different economic conditions facing different intermediaries[54] is nothing but misguided speculation. She claims that "there is no valid economic basis to assume that a small subset of intermediaries would be representative of the experience of all other intermediaries."[55] Here is the valid reason: these intermediaries are all buying cells in the same competitive marketplaces and all selling battery packs in the same competitive marketplaces, which means that the pass-through rate is largely market-determined and widely experienced. Dr. Haider does not present a reason to believe otherwise. I repeatedly addressed this in my reports.[56] Specifically, I explained that the only possibility that a 0% pass-through may occur in a competitive model is "when the cost increase is suffered by a small fraction of suppliers who do not have the power to affect the market price"[57] which can be ruled out in this case.

41. Lastly, Dr. Haider's specific criticism that I did not "analyze pass-through of any alleged cell overcharge from Simplo Taiwan to its distribution subsidiary in the

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[52] Haider Report, 42: "To be clear, the issue is not whether Dr. Leamer analyzes small or large data samples, but whether he is using data samples that are representative such that they can be used to draw conclusions related to pass-through for the numerous intermediaries in the distribution chain and all or virtually all members of the proposed class."

[53] Leamer Opening Report, 46-50.

[54] Haider Report, 43.

[55] Haider Report, 43.

[56] *See e.g.*, Leamer Reply Report, 49-50.

[57] Leamer Reply Report, 50.

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U.S."[58] has now been addressed. The pass-through regression analyzes the relationship of pack prices charged by Simplo USA to Dell and cell prices Defendants charged Simplo Taiwan and their other entities. Hence, the regression estimates the direct pass-through from cells charged to Simplo to pack prices charged to Dell. There is no reason to additionally analyze the pass-through from Simplo Taiwan to Simplo USA because this pass-through is accounted for in my regressions. Nonetheless, I examined the data on costs to Simplo USA on packs from Simplo Taiwan. These data have a highly unusual feature that the margin between price and cost is fixed throughout each year but varies from year to year. Within each year, this arrangement results in exactly 100% pass-through.

IV. Dr. Haider's Claims About Short-Run and Long-Run Pass-Through Are Misleading

A. Pass-Through Occurs Both in Short-Run and in Long-Run

42. The dynamic models of pass-through that I have estimated allow for the possibility of pass-through of part of a cost increase in the very month that the cost increase occurred and more later on. Dr. Haider has focused attention on the statistical significance of the estimate of the immediate first-month effect. There are two reasons why this is an intellectual diversion, not a genuine issue. First of all, our damages calculation begins in January 2000 and ends in April 2011, a total class period comprising 136 months. Dr. Haider's first-month concern applies only, at most, to January 2000 since by February 2000 the cost increase that occurred in January 2000 would be in the second month. Secondly, there is an inevitable statistical problem when trying to estimate the response month by month–the data may not be up to the task. This can cause large standard errors and statistically insignificant results. The Defendants' experts have repeatedly changed the reality of "hard to estimate" into the fiction of "no pass-through." That is just wrong.

[58] Haider Report, 43.

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43. The main purpose of the dynamic pass-through model is not to estimate the impact month-by-month but to estimate the long-run effect with the greatest accuracy, allowing for the possibility that the short-run and long-run might be different. We are dealing with 136 months of impact and if it took 100 months to approach the long-run effect, that would surely be a material concern, but most of the effect is achieved within a six-month time interval. Dr. Haider's discussion of the short-run coefficient is a misleading distraction.

44. Regarding the point about statistical significance, I will discuss the issue in detail below, in Section IV.D, "Small Cost Changes are Passed on both in Short-Run and Long-Run." In particular, Figure 13 in that section depicts confidence bands on a month-by-month basis, illustrating how the bands may be wide (in some cases) in the first few months of impact but become narrower as time proceeds. Despite the statistical imprecision of the estimated immediate effect of a cost change, within a matter of months, the estimate is precise enough to achieve a traditional level of statistical significance. This is typical of all my pass-through analyses. If the long-run effect is positive and statistically significant, a small or even negative statistically insignificant point estimate for initial impact should not be cause for concern.

B. Simplo and Dynapack Pass-Through Regressions

45. To make the short-run vs. long-run pass-through rates clear in my packer pass-through regressions, I present the same regressions as before but now include the estimate of the pass-through in the first and second months following the month when the cell purchase was made by the packer. These results are presented in Figure 7 through Figure 8. Here, I correct the error in the analysis of Simplo/Dynapack to Acer pass-through regression that excluded Dynapack sales from the regression and present the results in Figure 8.[59]

[59] *See* Haider Report, 40. I corrected the procedure to match cell prices charged to Dynapack by cell capacity and month. The resulting share of Dynapack in the sample is about 5% of the observations and 1.5% of sales. This is because, according to Acer procurement data, 96% of battery purchases were made from Simplo and a very small portion from Dynapack.

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46. The short-run effects after the contemporaneous month are positive and statistically significant for all regressions but Simplo USA. For the latter, the short-run pass-through rates are positive but statistically significant starting in the second month after the cell purchase.

Figure 7: Pass-Through from Simplo to Dell: Simplo USA

[redacted]

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Figure 8: Pass-Through from Simplo / Dynapack to Acer

Simplo/Dynapack Battery Pack Prices to Acer vs Cell Prices Charged to Simplo/Dynapack
2008 - 2011

Dependent Variable: Simplo Pack Price per Cell by Packer-Capacity-Manufacturer-Number of Cells[1] and Dynapack Pack Price per Cell by Packer-Capacity-Number of Cells[2]

	No Fixed Effects				Fixed Effect			
Variable	Estimate	St. Error	T-Value	P-Value	Estimate	St. Error	T-Value	P-Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Pack Price per Cell by Packer-Capacity-Mfr-Num of Cells (-1)	0.7467 ***	0.0515	14.4979	0.0000	0.5551 ***	0.0619	8.9688	0.0000
Cell Price by Capacity and Mfr[3]	0.2659	0.2653	1.0025	0.3174	0.0546	0.2608	0.2093	0.8345
Cell Price by Capacity and Mfr (-1)	0.0724	0.2713	0.2668	0.7899	0.3507	0.2671	1.3129	0.1909
Constant	0.2408 **	0.0996	2.4176	0.0165	0.9014 ***	0.1563	5.7655	0.0000
Number of Cells Fixed Effects	Yes							
Packer, Cell Capacity, Mfr, Number of Cells Fixed Effects	No				Yes			
Quantity Weights	Yes				Yes			
Short-Run Pass-Through								
1st month following cell purchase	**0.5369** **	**0.2112**	**2.5421**	**0.0110**	**0.4356** ***	**0.1656**	**2.6298**	**0.0085**
2nd month following cell purchase	**0.7392** ***	**0.1819**	**4.0627**	**0.0000**	**0.6471** ***	**0.1300**	**4.9764**	**0.0000**
Long-Run Pass-Through	**1.3354** ***	**0.1231**	**10.8468**	**0.0000**	**0.9110** ***	**0.0965**	**9.4357**	**0.0000**
R-square	0.9254				0.9386			
Observations	202				202			

Notes: [1] Per-cell monthly weighted average pack price by packer, cell capacity, mfr, and number of cells for Simplo.
[2] Per-cell monthly weighted average pack price by packer, cell capacity, and number of cells for Dynapack.
[3] Monthly weighted average price of cell sold to packer by cell capacity and manufacturer.
[4] *** Statistically Significant at 99%; ** Statistically Significant at 95%; *Statistically Significant at 90%.

Figure 9: Pass-Through from Dynapack to Dell

Dynapack Battery Pack Prices to Dell vs Cell Prices Charged to Dynapack
2006 - 2011

Dependent Variable: Pack Price per Cell by Capacity-Manufacturer-Number of Cells[1]

	No Fixed Effects				Fixed Effect			
Variable	Estimate	St. Error	T-Value	P-Value	Estimate	St. Error	T-Value	P-Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Pack Price per Cell by Capacity-Mfr-Num of Cells (-1)	0.4703 ***	0.0555	8.4673	0.0000	0.2620 ***	0.0599	4.3734	0.0000
Cell Price by Capacity and Mfr[2]	0.1757	0.3045	0.5772	0.5642	0.3860	0.2924	1.3198	0.1878
Cell Price by Capacity and Mfr (-1)	0.2601	0.3043	0.8548	0.3933	0.2567	0.2914	0.8808	0.3791
Constant	2.8020 ***	0.3405	8.2289	0.0000	2.4939 ***	0.2655	9.3944	0.0000
Number of Cells Fixed Effects	Yes							
Cell Capacity, Mfr, Number of Cells Fixed Effects	No				Yes			
Quantity Weights	Yes				Yes			
Short-Run Pass-Through								
1st month following cell purchase	**0.5185** ***	**0.1577**	**3.2869**	**0.0010**	**0.7438** ***	**0.0992**	**7.4977**	**0.0000**
2nd month following cell purchase	**0.6797** ***	**0.1035**	**6.5681**	**0.0000**	**0.8375** ***	**0.0708**	**11.8356**	**0.0000**
Long-Run Pass-Through	**0.8228** ***	**0.0928**	**8.8647**	**0.0000**	**0.8708** ***	**0.0729**	**11.9404**	**0.0000**
R-square	0.7304				0.7737			
Observations	343				343			

Notes: [1] Per-cell monthly weighted average pack price by cell capacity, manufacturer, and number of cells.
[2] Monthly weighted average price of cell sold to packer by cell capacity and manufacturer.
[3] *** Statistically Significant at 99%; ** Statistically Significant at 95%; *Statistically Significant at 90%.

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47. Finally, I conduct a regression utilizing a new dataset from Simplo Taiwan that was made available to me after the previous report. This dataset contains Simplo Taiwan's sales of cylindrical lithium-ion battery packs 2006 to 2011.[60] The battery description indicates characteristics, such as the arrangement of cells in the pack (e.g. 3S2P), cell capacity, and cell manufacturer. In addition, the data contain the total cost of the pack to Simplo.

48. Like the other packer analyses, I estimate the cost of cells in the Simplo packs by computing the quantity-weighted average cell price charged by the Defendants to Simplo by cell capacity, cell manufacturer, and month. I regress the price of the pack (per cell) charged by Simplo to customers on the cell price charged to Simplo, also including the lagged variables as before. I include two additional variables in this regression – the cost of other non-cell components in the pack and its lagged value. These costs are computed as the difference between per-cell cost of the entire pack and the cost of the cell. This additional feature allows us to control for non-cell packing costs and compare the pass-through rates of the cell costs and non-cell packing costs.

49. Figure 10 shows the results of this regression. All short-run and long-run cell cost pass-through rates are positive and statistically significant. In the long-run the pass-through rate is just above 100% in both the no-fixed effects and fixed effects models. The long-run pass-through rates of non-cell pack costs are also computed and are virtually the same as the pass-through rates of the cell costs.

50. One issue with using cell cost measure matched from the Defendant data is that I lose more than half of Simplo pack sales data because a contemporaneous sale from Defendant that matches the sale of pack may not exist. However, I can estimate the pass-through rate using the Total Pack Cost instead and utilize a more complete packer sales data. The results of this regression are reported in Figure 11. The number of observations in this regression is nearly twice as large

[60] I also received additional Simplo Taiwan data for the post-2011 period on the submission day of this report. I reserve the right to review and supplement my work and opinions based on these data in the future.

as in the previous one. The pass-through rates support all previous assessments–complete positive statistically significant pass-through.

Figure 10: Simplo Taiwan Pass-Through of Cell Costs and Other Costs

[redacted]

Figure 11: Simplo Taiwan Total Pack Cost Pass-Through

[redacted]

51. In Figure 12 below, I summarize the data used in these packer pass-through regressions. In total, I analyzed over 580 million cells in packs accounting for over 2.5 billion dollars' worth of sales.

Figure 12: Summary of Data Analyzed in Packer Pass-Through Regressions

[redacted]

C. Dr. Haider Does Not Identify Any Left-Out Variables or Show That the Issue Is Material

52. Finally, in a footnote to her report, Dr. Haider claims that my packer pass-through "regressions yield results that are biased and unreliable" because they suffer from omitted variable bias and endogeneity.[61] Not surprisingly, these are the two premier problems that are discussed in any econometric class, but it is not enough just to say a regression model *might* be afflicted by omitted variable bias and endogeneity. We all know that. The word "might" cannot be turned to "is" or "are" without evidence, as Dr. Haider has done. It's not enough merely to observe that the patient might have a headache or a sore throat. We all know that. These concerns of Dr. Haider have meaning only if she can demonstrate that her treatment of either the omitted variables problems or the endogeneity problem materially changes the inferences. This remains another baseless and misguided critique with little explanation and no demonstration by Dr. Haider.

[61] Haider Report, 46.

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53. Regarding the omitted variable bias, Dr. Haider states that the model contains no "time-varying demand and supply factors that contemporaneously affected prices paid for packs," and "also ignores any contemporaneous effects on prices paid of other economic factors such as the recession, the Sony recall, and fires at Panasonic and LG Chem plants."[62] Dr. Haider does not test or provide any analysis to demonstrate whether there is an actual bias or its direction, since an omitted variable bias could be downwards or upwards. It is important to keep in mind that common factors that affect both cost and price are part of the pass-through estimation.

54. The last sentence of Dr. Haider's footnote 136 is "Finally, as noted above, his regressions also suffer from an endogeneity problem."[63] It appears that she is referring to her earlier comment about the number of cells in the pack in footnote 126. I couldn't find any clear articulation of an endogeneity problem in either footnote 136 or in footnote 126. An endogeneity problem refers to an explanatory variable which is jointly and simultaneously determined with the dependent variable (price of the pack). Dr. Haider seems to think that the number of cells is the problem variable because I have used price per cell as the dependent variable. I regard the number of cells as a fixed feature of the product and assume that the price of the pack is influenced by the number of cells. I have used price per cell as the dependent variable and included number of cells in the packs to allow for the possibility that the packing margin (markup of price over cell cost) could vary with the number of cells. It could be that the cost of packing is proportional to the number of cells, or is a fixed cost that doesn't depend on the number of cells or is especially high when the number of cells is high. If all of this is true, there is no endogeneity problem in my work. Bottom line: this concern is poorly articulated, probably not material, and remains entirely speculative. If Dr. Haider thought this was a real problem there

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[62] Haider Report, 46.

[63] Haider Report, 48.

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is an easy fix: estimate a model with price as the dependent variable, not price per cell.

D. Small Cost Changes Are Passed-On in Both the Short-Run and Long-Run

55. Dr. Haider's Exhibit 7 is a version of my study of the pass-through of small cost changes, using new third-party data from my Supplemental Report. She completely misinterprets her exhibit as supporting the hypothesis that small cost changes are not passed on.

> I explained above that if an intermediary in a specific distribution chain absorbs a cost change in the short term and passes it on with a delay, there would be no pass-through to intermediaries further down the chain in the interim time period and thus, no pass-through to proposed class members that purchased the particular finished products coming down from that specific chain during that period. These proposed class members would not have suffered injury from the alleged conduct.[64]

56. The model that Dr. Haider reports has two variables to capture the short-term effect of changes in unit costs: Unit Cost – Unit Cost(-1) and (Unit Cost – Unit Cost(-1))*(Abs Change ($0 – 3.5)). The first variable applies to all cost changes and has a positive statistically significant estimate. The second applies only to price changes less than $3.5. This second coefficient is not answering the question of what happens if the price change is less than $3.5. It is answering the question of whether the response to small price changes is different from large ones. Because this second coefficient is statistically insignificant, the data are answering this question, saying "Not really, small price changes are passed along the same way as large ones."

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[64] Haider Report, 70.

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57. Dr. Haider also criticizes my threshold pass-through results (Figure 16 of my Reply Report, in which I showed that even smaller cost increases are passed though) based on the nature of the dynamics I estimated.[65] Although I found positive long-run pass-through that was statistically significant at conventional levels, the short-run estimates are less precise and can in some cases be small or even negative. That is to be expected with imprecise estimates, but Dr. Haider for rhetorical purposes would have us replace the word "imprecise" with zero. Let's resist that idea and stick with imprecise.

58. Although the results are imprecise for my short-run pass-through, the long run is not a problem. As Dr. Haider could have easily checked, my results can be used to determine not just the immediate (short-run) effect or the ultimate (long-run) effect, but also the 1 month, 2 month, 3 month, etc. effects. For example, Figure 13, using the same data[66] as Dr. Haider's Exhibit 7, shows the estimated pass-through of small and large cost changes, below and above $3.5 for each period as well as the 95 percent confidence interval for the estimates.

59. This figure has three prominent features: (1) the pass-through rates elevate with time; (2) the confidence intervals for large cost changes never overlaps with zero which means statistical significance at every delay period; (3) the confidence interval for small price changes is wide enough in the first month to include both 100% and -100%, but after three months is bounded away from zero. This wide confidence interval does not mean there is evidence supporting no pass-through in the short run as Dr. Haider would have us conclude. What it means is that this experiment is not adequate for estimating the short-run pass-through rates of small cost changes. Keep in mind that imprecise is not the same as zero.

[65] Haider Report, 69-72.

[66] All OEM, distributor, and retailer data.

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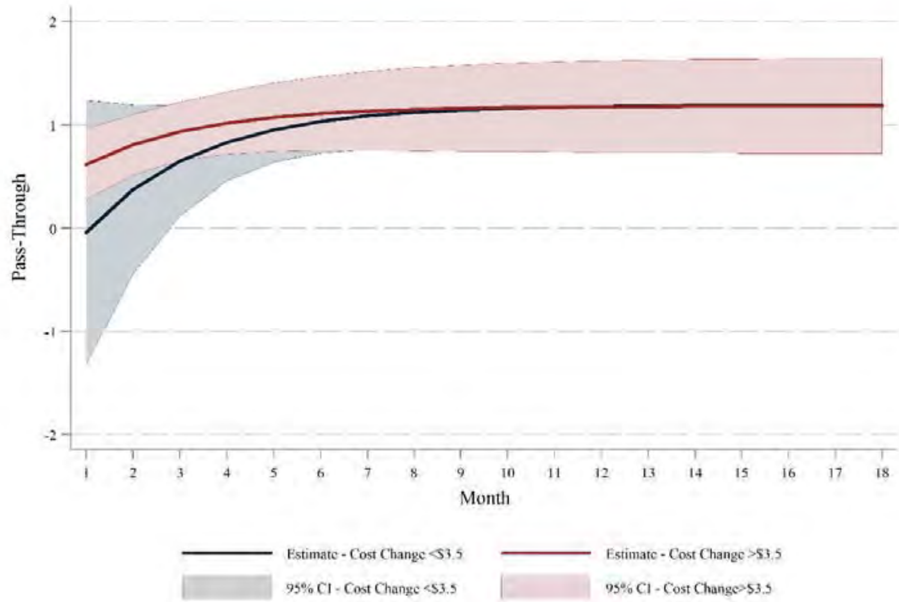
Figure 13: Smaller and Larger Than $3.5 Cost Change Pass-Through Over Time



Source: Haider Report Work Papers

V. Dr. Haider Misrepresents My Analysis of Packer Pass-Through Using Defendant Data

60. In addition to the packer pass-through regressions, I provided an analysis using the Defendants' data that further confirms the existence of positive pass-through to all packs in the market. I explained that this is not a traditional "pass-through" analysis, but is nevertheless informative about packer pass-through.[67]

61. Dr. Haider contends that this analysis "does not constitute an economic analysis of actual pass-through from third-party packers to their customers."[68] She also states that "the assumption underlying … [the analysis] is that Defendants' sales of packs can be used as a proxy for third-party packers' sales of packs."[69] This critique entirely misses the point of the analysis and the evidence it provides

[67] Leamer Supplemental Report, 17-20.

[68] Haider Report, 47.

[69] Haider Report, 48.

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about packer pass-through. As I explained in my deposition, this analysis studies the market-determined rate of pass-through for the battery packs.[70] There is no reason to believe that the market-determined pass-through rates would not apply to the non-defendant packers.

62. Similarly, Dr. Haider offers an empty critique that not all Defendant sales of cells and packs are used in my analysis.[71] The prices of packs sold to customers are matched to corresponding prices of the type of cells that are used in those packs (i.e., the same cell part number) in the same month. If there were no sales of a particular cell part number in the concurrent month of the pack sale that contained the specific cell part number, the sales of that pack were not be included in the analysis. Dr. Haider did not contend that the omission of this portion of pack sales would lead to any material difference to the results. In addition, I used only external sales of LIB cells, i.e., sales not sold to internal customers for the vertically integrated Defendants. The inclusion of these sales, however, has no material effect on the results of this regression.

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[70] Deposition of Edward E. Leamer, Ph.D., April 26, 2016 at 287:5-20 ("Leamer Deposition").

[71] Haider Report, 48.

Figure 14

Defendant Pack "Pass-Through" Regressions
Sensitivity to Internal Sales
1997 - 2013

Dependent Variable: Pack Price per Cell

	No Cell Product Number Fixed Effects				Cell Product Number Fixed Effects			
Variable	Estimate	St Error	T-Value	P-Value	Estimate	St Error	T-Value	P-Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Pack Price per Cell (-1)	0 9555	0 0027	356 3642	0 0000	0 8458	0 0048	175 7133	0 0000
Price of Cell in Pack	0 1635	0 0096	16 9703	0 0000	0 2104	0 0098	21 5082	0 0000
Price of Cell in Pack (-1)	-0 1048	0 0098	-10 7141	0 0000	-0 0209	0 0102	-2 0418	0 0412
Number of Cells	Yes							
Cell Prod Number Fixed Effects	No				Yes			
Quantity Weights	Yes				Yes			
Short-Run Pass-Through								
1st month following cell purchase	**0.2149** ***	**0.0111**	**19.3041**	**0.0000**	**0.3675** ***	**0.0123**	**29.7545**	**0.0000**
2nd month following cell purchase	**0.2641** ***	**0.0137**	**19.2246**	**0.0000**	**0.5003** ***	**0.0159**	**31.4663**	**0.0000**
Long-Run Pass-Through	**1.3176** ***	**0.0680**	**19.3733**	**0.0000**	**1.2288** ***	**0.0337**	**36.4288**	**0.0000**
R-square	0 9734				0 9767			
Observations	11,513				11,513			

Note: (1) Dep Var : Per-cell monthly weighted average pack price by cell product number
Ind Var : Monthly weighted average price of cell product number within a pack
(2) Including internal sales

1. Dr. Haider Has Not Demonstrated That Prices Charged by Defendant and Non-Defendant Packers Don't Move Together

63. Dr. Haider criticizes my correlation study that "prices charged to customers for comparable packs by defendants and by non-defendant packers generally track together."[72] First, she contends that I did not demonstrate that the data used are representative of all third-party packer sales.[73] I addressed above the issue of representativeness of this data.

[72] Haider Report, 49; Leamer Supplemental Report, 18-20.

[73] Haider Report, 49.

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64. Second, she states that "[a] positive correlation is not sufficient to show that these packers had the same responses to increases in underlying costs."[74] Again, Dr. Haider misses the point of this analysis. As I explained, the point of this analysis is to study "whether … pass-through is driven by market forces."[75] The positive correlation correlations additionally confirm the expectations from theory and evidence that market pass-through rates apply to everyone.

65. Third, Dr. Haider presents one example of a pair of pack prices to argue that "prices charged to the same OEM for a similar pack from these types of packers did not generally track together."[76] Parenthetically, if these were actually identical packs, you have to wonder why the OEM procurement department did not opt for the cheaper supplier. But the example she presents is misleading. Out of 27 options in my Figure 7, she picked a price series corresponding to one of the batteries with the lowest volume of sales.[77] This is particularly surprising, given Dr. Haider's concern about representativeness elsewhere in her report. In contrast, the example I used in Figure 6 of my Supplemental Report uses one of the two highest sale items. The problem with an example based on a low-volume pack type is that it provides fewer data points for the comparison (14 in her chart vs. 46 in my chart), and those data points would be subject to more noise.

66. In addition, Dr. Haider's chart itself is misleading because the absence of data points when no sales occurred is disguised by lines that connect the data points that are available. Figure 15, below, provides an accurate representation of the data with lines connecting only adjacent monthly prices.[78] It is clear that there

[74] Haider Report, 50.

[75] Leamer Supplemental Report, 18.

[76] Haider Report, 50.

[77] She uses 3-cell battery packs containing 2200mAh Samsung cells sold by Dynapack and Samsung. This corresponds to row 10 of the Figure 7 in my Supplemental Report. In contrast, the example I used in Figure 6 of Supplemental Report uses one of the two highest sale items in row 15. *See* Leamer Supplemental Report, 19-20.

[78] The price series in Dr. Haider's Exhibit 4 and Appendix Chart F-1 were also mislabeled with the top series

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are two distinct periods where the prices series can be compared with a 7-month gap in-between. Within each of these two periods the price series indeed appear to track together. The downward shift of the Samsung series could be due to different types of packs sold in each of the two periods, i.e., a change other than the capacity and number of cells.[79]

67. Dr. Haider includes another misleading chart in her Appendix F-1 that creates the appearance of a persistent divergence between the packer and Defendant pack prices. It fits straight lines over just three months of data (out of 24 months in the chart) and does not show data points that would indicate that the gap between two of the points is nearly two years apart. The actual data points are displayed in Figure 16 below. Dr. Haider uses her chart to claim that "while the price Sony charged Dell declined, the price Simplo charged Dell for a similar pack increased."[80] In addition, she criticizes me for not including these series with three disjoint data points in my correlation analysis. Doing so would be have been uninformative. In her own presentation of this data, Dr. Haider has chosen to be misleading.

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being mistakenly labeled as Samsung and the bottom series as Dynapack. The corrected charts below show the right labels. *See* Haider Report, 51, 132.

[79] According to the sales data, Packs sold by Samsung in earlier periods primarily contained cells with product number ICR18650-22F but in later periods contained cells with product number ICR18650-22H

[80] Haider Report, 50.

Figure 15

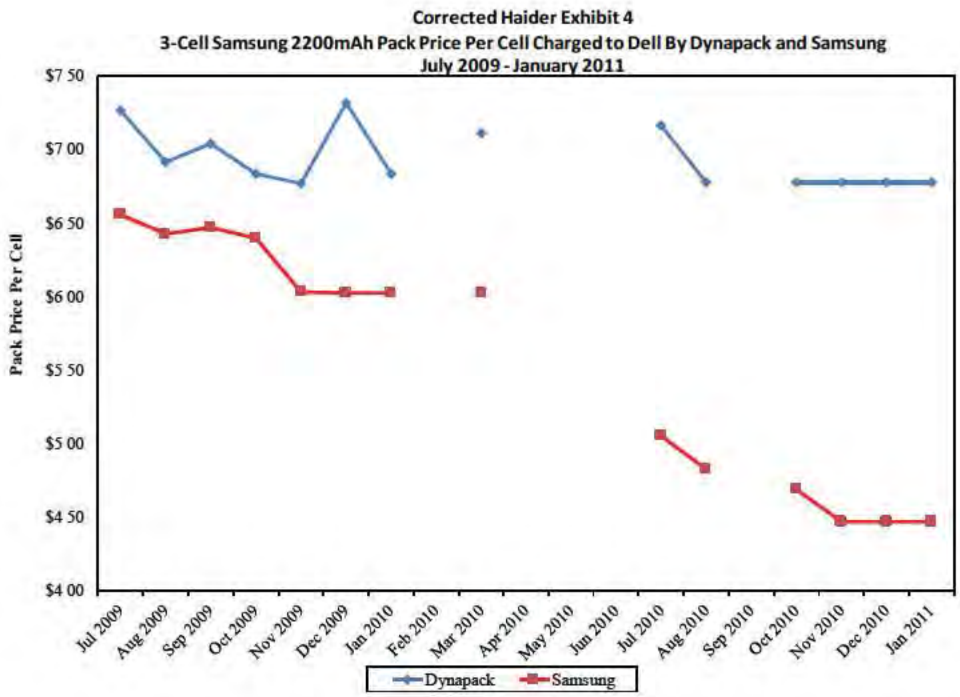
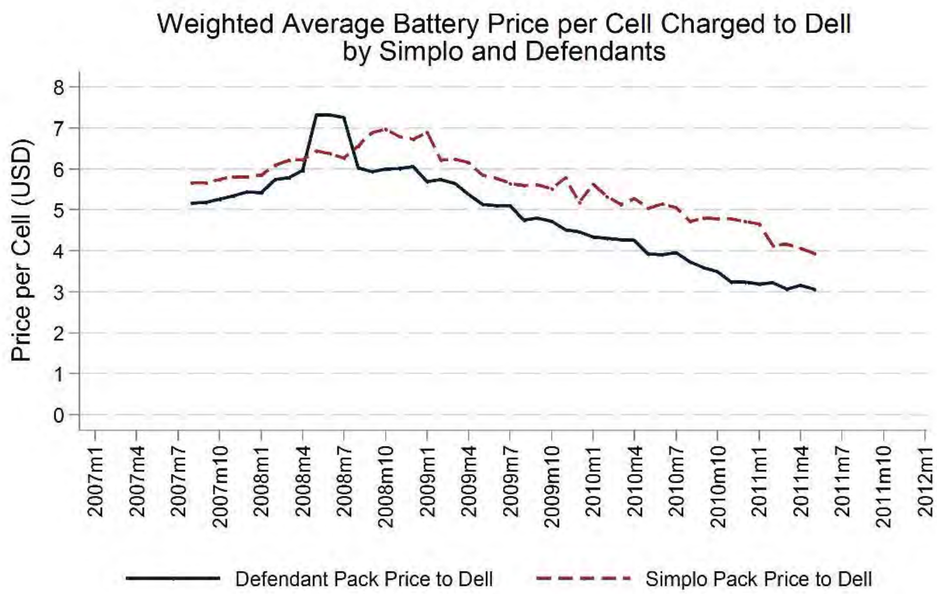


Figure 16

[redacted]

68. Another way to show the co-movement of prices is by plotting composite prices series across all available products. In Figure 17 below, I show the average prices charged by Simplo and Defendants to Dell for similar battery packs.[81] This picture is similar to the example presented in Figure 6 of my Supplemental Report. Figure 18 shows the analogous chart for prices charged to Acer by Simplo and Defendants and Figure 19 shows prices charged to Dell by Dynapack and Defendants. The charts show the co-movement of prices charged by Defendants and the packer, though the Dynapack price data are noisy.

Figure 17



Note: All battery packs sold to Dell by Simplo and Defendants. Prices are weighted by cell quantity.

Source: Leamer Supplemental Report Work Papers

[81] The price series correspond to rows 15 through 27 of Figure 7 in my Supplemental Report. *See* Leamer Supplemental Report, 20.

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Figure 18

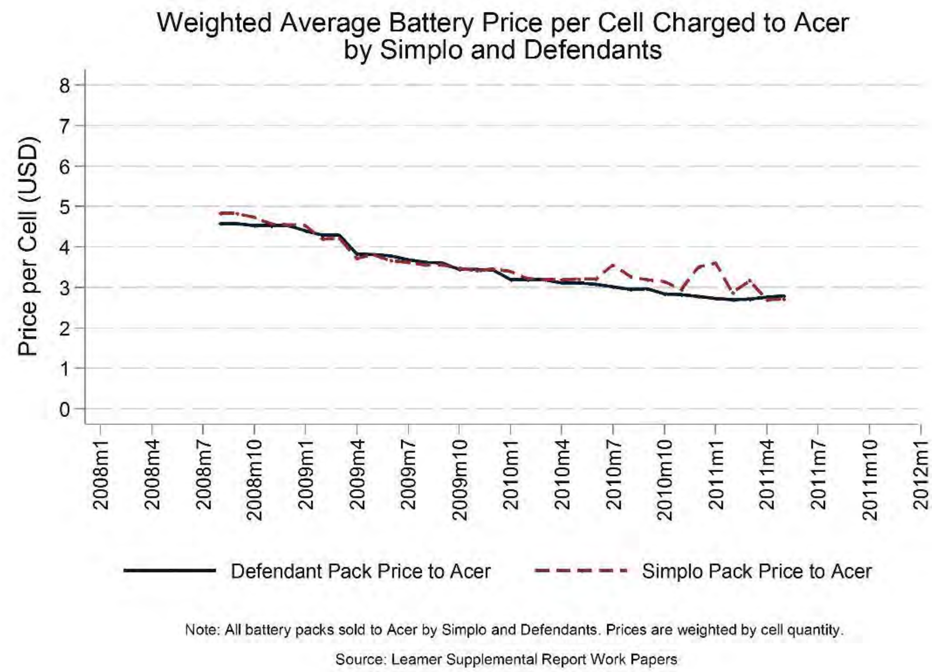
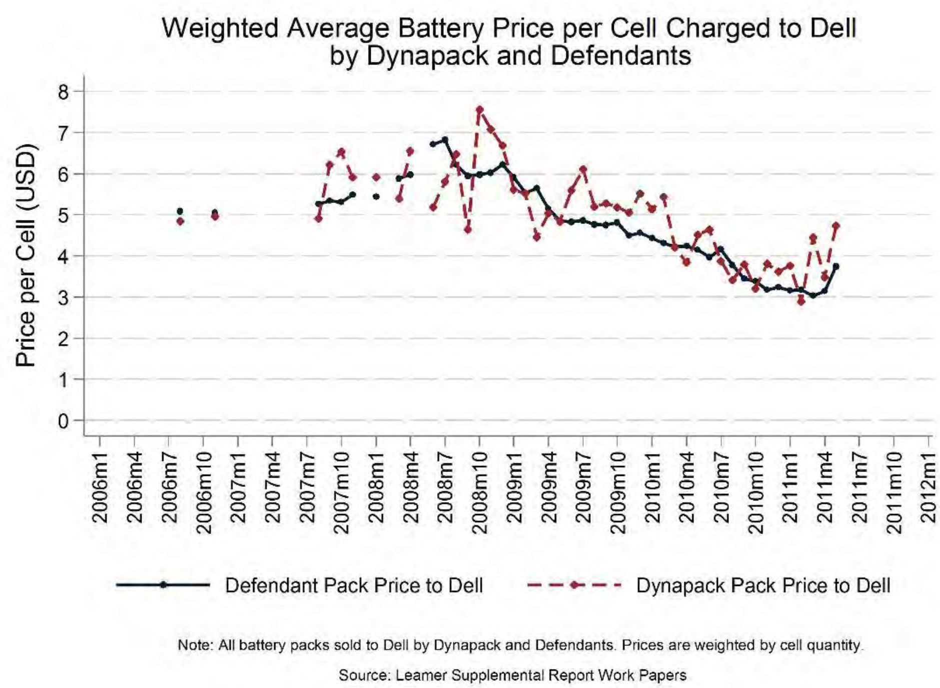


Figure 19



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VI. Dr. Haider's Claim That the Two Major Third-Party Packers Did Not Suffer Injury Is Based on Faulty Analysis and Is Wrong

69. Dr. Haider disputes that the two packers used in my analyses above "sustained overcharges on cells they bought from Defendant manufacturers."[82] In support of her claim, she applies the overcharge regression model in my Opening Report[83] to two subsets of the full dataset – cell sales to Simplo and cell sales to Dynapack.[84] She performs two versions of this analysis: 1) using the entire period for which Simplo and Dynapack sales are observed and 2) excluding sales in the "Alternative Cobalt Sensitivity Period" spanning from April 2007 to December 2009. In the first version, she finds that the "model yields a *negative* and statistically significant overcharge for Dynapack"[85] and a positive and statistically significant overcharge for Simplo. In the second version, she finds negative and statistically significant overcharge for Dynapack and positive statistically insignificant results for Simplo. She concludes that "outside of this [April 2007 – December 2009] period, Simplo had no overcharges"[86] and "Dynapack had no cell overcharges"[87] at all.

70. The two misguided modifications of my overcharge model proposed by Dr. Haider are the same modifications that the previous Defense expert, Ms. Guerin-Calvert, performed in her Report.[88] I have addressed in detail both the dangers of blind data disaggregation and removing data inside the "Cobalt Sensitivity Period" in my Reply Report to Ms. Guerin-Calvert.[89]

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82 Haider Report, 51.

83 Leamer Opening Report, 57.

84 Haider Report, 51-53.

85 Haider Report, 52.

86 Haider Report, 53.

87 Haider Report, 52.

88 Guerin-Calvert Report, 17-20.

89 Leamer Reply Report, 25-34.

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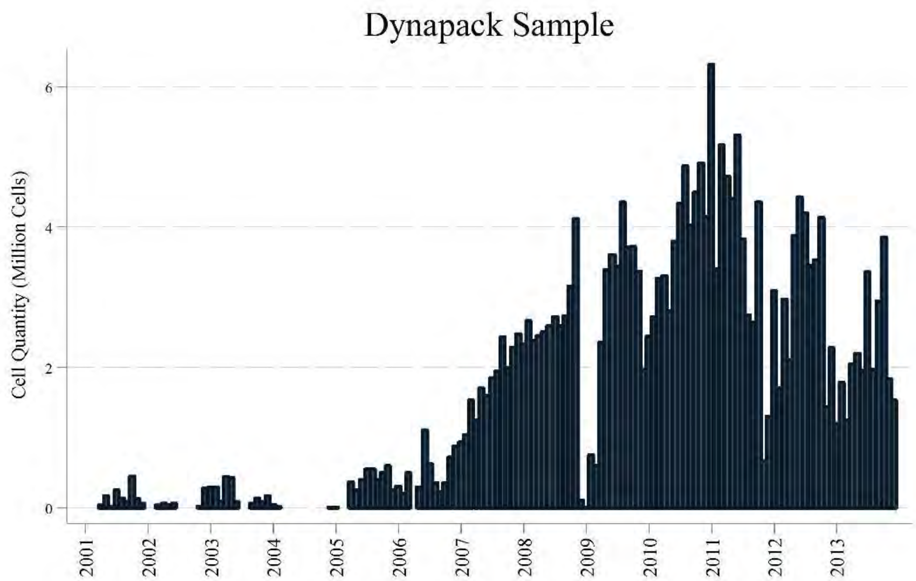
71. **Data Disaggregation.** Similar to Ms. Guerin-Calvert, Dr. Haider obtains wild and meaningless estimates by slicing the data by slicing the data into five subsets: 1) Simplo purchases, 2) Simplo purchases with the cobalt period removed, 3) Dynapack purchases, 4) Dynapack purchases with the cobalt period removed, 5) all purchases of cells, but excluding the cobalt period. One of the most problematic of these subsamples is Dynapack purchases, which is evident in Figure 20 below. The Dynapack subsample is entirely missing the "before" period that is used in my "before and after" overcharge regression model to detect the conspiracy effect. Moreover, there are very little data prior to the cobalt sensitivity period (e.g., there are almost no data in the entire year of 2004) and very little data in 2 months in the middle of the cobalt sensitivity period. This missing data make it very difficult to estimate the effect of cobalt sensitivity.[90]

72. As a result of these limitations, Dr. Haider obtains noisy and counterintuitive results. For example, the two coefficients that capture the effect of the cobalt sensitivity period both become statistically insignificant. Also, the 5 out of 7 variables meant to capture critical macroeconomic conditions are insignificant in the Dynapack subsample regression. Hence, the regression run on this model has very little ability to account for relevant market conditions in order to identify the conspiracy effect. Finally, her result of a negative and statistically significant coefficient on the conspiracy variable (outside of the cobalt sensitivity) suggests that this decade-long conspiracy in fact *lowered* the battery prices compared to but-for prices. This is hard to believe, given all the evidence that has been presented in this case, and is likely the result of the inadequate sample used in a regression designed for a more complete dataset.

73. Simplo appears to be a more complete dataset and produces a positive significant conspiracy effect. Nonetheless, the best approach is to use the full data as I did in my initial report.

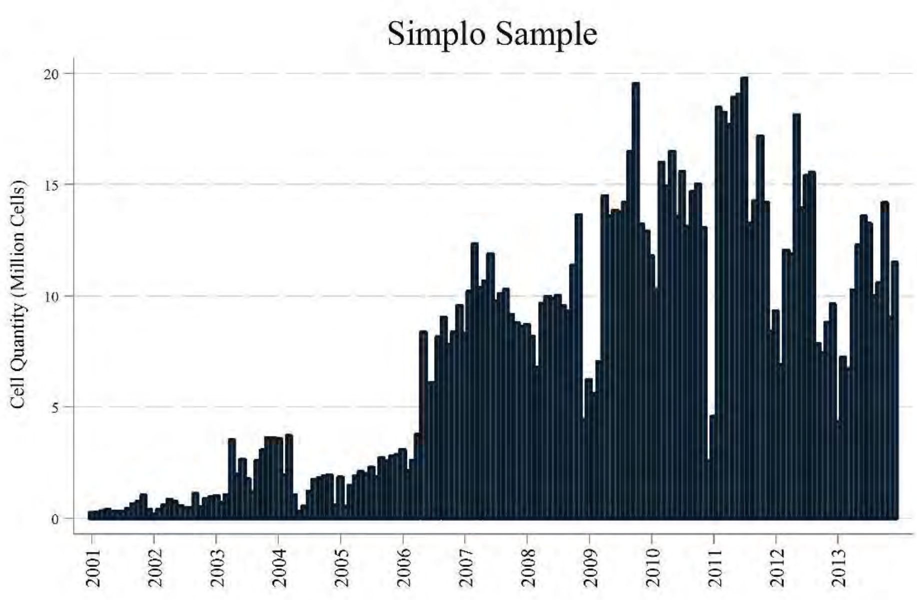
[90] While Ms. Guerin-Calvert's subsamples were different, those suffered from these same issues which I addressed in detail. *See*, Leamer Reply Report, 29-31.

Figure 20: Data Used in Dynapack Overcharge Regression by Dr. Haider



Source: Leamer Supplemental Report and Haider Report Work Papers

Figure 21: Data Used in Simplo Overcharge Regression by Dr. Haider



Source: Leamer Supplemental Report and Haider Report Work Papers

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74. **Omitting All Data in the Cobalt Period Is Not an Adequate Approach.** Three of the data slices that Dr. Haider makes eliminate all the data for the Cobalt Period in my regression. It is astounding that Dr. Haider conducted the exact same flawed analysis as Ms. Guerin-Calvert, without even a mention of my criticism of this approach.[91] In addition to the data limitations, she simply excludes almost 3 years of data during the cobalt sensitivity period. This severely limits both Dynapack and Simplo subsamples. It is not surprising that by doing this she eliminates the statistical significance of the conspiracy effect in the Simplo regression. In my Reply Report, I explained the importance of this period and that I do not regard the elimination of it as a valid approach.[92]

75. **Common Impact Regressions Showed Injury for Packers.** In my Opening Report, I presented a Common Impact Regression analysis that demonstrated that all or almost all class members would be impacted by the conspiracy.[93] I performed this analysis for individual cell product numbers and individual customers. The latter included third-party packers such as Simplo and Dynapack. In Figure 22 below I present the results from this analysis for Simplo and Dynapack.[94] This analysis showed that both Simplo and Dynapack would be impacted by the cartel overcharge. Neither Dr. Haider nor the previous Defense expert, Ms. Guerin-Calvert, objected to this analysis as a method of showing common impact of the injury.

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[91] *See* Guerin-Calvert Report, 17-20; Leamer Reply Report, 32-34.

[92] Leamer Reply Report 32-34.

[93] Leamer Opening Report, 32-46.

[94] The regression for Simplo was presented in Figure 30 of my Opening Report. The regression results for Dynapack are obtained directly from the backup produced with my Opening Report. No new regressions have been performed. *See* Leamer Opening Report, 32-46 for a detailed description of this analysis and results.

Figure 22

Common Impact Regression Model
SIMPLO TECHNOLOGY and DYNAPACK vs All Other LIB Purchasers

Variable	Estimates	T-Stat
(1)	(2)	(4)
SIMPLO		
Dependent Variable		
*DLog(**Cell** Price SIMPLO TECHNOLOGY)*		
Contemporaneous Effect		
DLog(**Cell** Price All Other Purchasers)	0.2506 ***	6.1191
Lagged Effect		
Log(**Cell** Price All Other Purchasers(-1) / (**Cell** Price SIMPLO TECHNOLOGY))(-1))	0.0528 ***	4.6307
Total (Contemporaneous + Lagged Effect)	0.3035 ***	6.8550
DYNAPACK		
Dependent Variable		
*DLog(**Cell** Price DYNAPACK)*		
Contemporaneous Effect		
DLog(**Cell** Price All Other Purchasers)	0.2873 ***	4.0220
Lagged Effect		
Log(**Cell** Price All Other Purchasers(-1) / (**Cell** Price DYNAPACK))(-1))	0.0489 **	2.2901
Total (Contemporaneous + Lagged Effect)	0.3361 ***	4.2809

*** Statistically Significant at 99%; ** Statistically Significant at 95%; *Statistically Significant at 90%.

Note: (1) Regression results for Simplo reported in Figure 30 of Leamer Class Cert Report; results for Dynapack provided in Leamer Class Cert Report Work Papers.

Source: Leamer Class Cert Report Work Papers.

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VII. Dr. Haider Does Not Address My Analysis of Rebates, Discounts, and Bundles in a Meaningful Way

A. Rebates and Discounts

76. Dr. Haider states that I ignore "substantial rebates and discounts to proposed class members and intermediaries in the distribution chain" contending that I only presented a few example regressions in my rebates and discount related regressions.[95] Dr. Haider offers only vague and irrelevant discussions.

77. In my report, I explained why, as a matter of econometric theory and practice, the presence of rebates and discounts would not result in my regressions overestimating pass-through. I explained that the measurement error in prices would not alter the pass-through estimates and the measurement error in costs would likely result in underestimation of the pass-through estimates.[96] The only comment that Dr. Haider makes in regard to this fundamental point is a vague assertion provided in a footnote, which states: "Dr. Leamer does not recognize that rebates and discounts vary based on the product purchased and customer. Accordingly, an *a priori* conclusion cannot be drawn about the consequence (i.e., bias) resulting from the measurement error in the price and cost variables."[97] Whatever does that mean? Dr. Haider does not elaborate or provide any specifics to back up her assertion, and the reference she cites is merely a textbook discussion of the measurement error. This vague comment can be regarded as no comment at all.

78. I presented several examples to confirm empirically the prediction from my discussion of the econometrics of measurement error from unknown rebates and discounts based on the data that I found. All the examples conformed with the econometric theory that I discussed. Dr. Haider's comments on these regressions are speculative and irrelevant.

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[95] Haider Report, 55.

[96] Leamer Supplemental Report, 22-23.

[97] Haider Report, 58.

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79. One of her comments is that the Gateway data used to study the effects of discounts "does not include Dr. Leamer's 'alternative cobalt sensitivity period,' … [or] the time period of financial crisis or the Sony recall."[98] She states that "[i]t is inappropriate to assume that the nature of discounting or its effects can be extended to a period of time with starkly different economic conditions."[99] But the issues here have nothing to do with the nature of the discounts or the effects of the discounts. It is strictly an accounting error – the business records provide us with either the wrong costs or the wrong prices. I suppose it is conceivable that the same accounting error could have different impacts on the pass-through estimates in different circumstances, but if that is what Dr. Haider is thinking, she needs to let us in on her secret. Why would that be? Another way of making the point is that an econometrician is not allowed to just throw variables into a regression equation until something happens. There has to be a compelling reason for the inclusion of the variables. The same point applies very strongly to slicing and dicing a dataset.

80. Dr. Haider conducts a test of whether the pass-through estimates for Dell are different before and after the cobalt sensitivity period using a Chow test.[100] Dr. Haider's test is of the equality of all coefficients, not the relevant pass-through coefficients. The regression on which Dr. Haider's Chow test relies finds positive, statistically significant long-run pass-through both before and after the cobalt sensitivity period that is nearly identical—131% before and 80% after. Hence, even in Dr. Haider's own test, the pass-through rates are positive and significant before and after. Dr. Haider's test is entirely irrelevant to the discussion that I presented and does not undermine it in any way.

81. Dr. Haider also argues that I "ignore[d] various forms of rebates and discounts provided to intermediaries in the complex distribution chain, … [such as] mail-in rebates, volume incentive rebates, price protection payments, and market

[98] Haider Report, 56.

[99] Haider Report, 56.

[100] Haider Report, 56.

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development funds."[101] In fact, my discussions and analyses apply to all forms of rebates and discounts because regardless of the form the effect is either a measurement error in price or a measurement error in cost.[102]

82. She states: "Dr. Leamer misses a crucial point [t]hat by failing to account for various forms of rebates and discounts in the distribution chain, he does not study the actual prices paid or actual cost. An intermediary that received rebate payments paid a different price net of rebates than an intermediary that did not receive rebate payments. Accordingly, price would not be measured correctly for the intermediary that received the rebate payment."[103] However, the effect of potentially unaccounted-for rebates and discounts is precisely what I studied and Dr. Haider did not offer any valid reason to believe that the results from the pass-through regressions are unreliable, despite her claims.[104]

83. Finally, Dr. Haider suggests that I did not study available rebates and discounts data from SED, Dell, and HP. While the examples presented in my report were already sufficient to support my conclusions about the effects of rebates and discounts, I have revisited the datasets mentioned by Dr. Haider.

84. SED data indeed contains rebates matched with the transactional data that can be used in my study of rebate effects. I conducted this additional study and the results are added to Figure 23 below. The results using SED data further confirm my original conclusions of the effects of rebates.

85. Dell data contains mail-in rebates *offered* to customers with the direct purchase order. I have no indication which of these mail-in rebates were *actually redeemed* by customers. Dr. Haider confirms that the data received does not show when a

[101] Haider Report, 56.

[102] Volume incentive rebates and price protection payments, given by manufacturers to retailers, affect the measurement of costs to the retailers or the measurement of the price charged by the manufacturers. Market Development Funds affect manufacturers' costs. *See* Haider Report, 56.

[103] Haider Report, 58.

[104] Haider Deposition, at 179:4-20.

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mail in rebate is redeemed, and therefore she does not include rebates as part of her empirical analyses.[105] However, one can study what effects it would have on the pass-through estimates assuming all the rebates offered were paid out. As I described earlier, this would result in a measurement error of gross prices and would not have a material effect on the pass-through estimates. In Figure 23 below, I report the results of this additional regression that confirm the expectations from theory.

86. It is unclear which discount data Dr. Haider is pointing to in her exhibits. Dell data provides what Dell calls "the retail value" and the actual consumer price paid for each direct-purchase customer order.[106] The difference between Dell's characterized retail value and the actual price paid can be thought of as a form of discount. I use this definition of a discount to provide another example of the discount effect. As results reported in Figure 23 show, the effect on pass-through estimates is immaterial, consistent with the expectations.

87. In addition, Dr. Haider suggests that HP data contain rebates that were ignored.[107] She presents an excerpt from that data in her Appendix Table H-13, which show four records of rebates with the rebates value of $100 under column [b] and 2 records with unclear rebate value.[108] However, these four records are the only records with rebate values in the entire HP dataset referenced by Dr. Haider. In addition the data would have to be matched with the sales data, which is not feasible. It is surprising that Dr. Haider would propose that this highly inadequate data be used in an analysis of rebates. It seems that Dr. Haider did not study the datasets she proposed to be used well enough to assess their usefulness.

[105] Haider Deposition, at 301:8-304:11.

[106] *See* Email from Matthew D. Kent to Attached Service List, Re: In re Lithium Ion Batteries Antitrust Litigation, Case No. 13-md-2420-YGR (DMR), (January 8, 2016).

[107] Haider Report, 57.

[108] Haider Report, 151.

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88. Lastly, Dr. Haider points out that the pass-through regressions presented for Gateway with fixed effects do not show statistically significant pass-through. This comment is also misleading. In the context of my general study of pass-through rates, the statistically insignificant coefficient in the Gateway fixed effects regression must be interpreted as only one of the many estimates I presented and summarized in analyses.[109] In particular, this is just one of the 110 regressions (provided in Figure 27 summary of my Supplemental Report), only two of which yielded pass-through rates that were statistically insignificant at conventional levels.[110] Furthermore, the Gateway regression without fixed effects—i.e., that utilized both intertemporal and cross-sectional information in the data—found a statistically significant positive pass-through.

Figure 23

Rebates/Discounts Pass-Through Analysis

	No Part Number Fixed Effects				Part Number Fixed Effects			
	With Rebates/Disounts		Without Rebates/Discounts		With Rebates/Disounts		Without Rebates/Discounts	
	Instant Rebates (Hypothetical Unknown True Cost)							
Company	Net Cost (Gross Cost - Rebates)		Gross Cost		Net Cost (Gross Cost - Rebates)		Gross Cost	
	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Retailers								
Insight	0 90	(0 87,0 92)	0 48	(0 41,0 54)	0 43	(0 41,0 46)	0 23	(0 21,0 26)
CompuCom	0 88	(0 86,0 9)	0 63	(0 61,0 65)	0 80	(0 78,0 82)	0 58	(0 56,0 6)
SED	1 03	(1 02,1 03)	0 93	(0 91,0 96)	1 00	(0 98,1 02)	1 00	(0 96,1 04)
Zones	1 03	(1 02,1 03)	0 95	(0 85,1 05)	0 93	(0 73,1 12)	0 54	(0 16,0 91)
	Mail-In Rebates (Hypothetical Unknown True Price)							
	Net Price (Gross Price - Discount)		Gross Price		Net Price (Gross Price - Discount)		Gross Price	
OEM	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
Dell	1 32	(1 28,1 35)	1 30	(1 26,1 33)	1 35	(1 26,1 43)	1 34	(1 25,1 43)
	Discounts (Hypothetical Unknown True Price)							
	Net Price (Gross Price - Discount)		Gross Price		Net Price (Gross Price - Discount)		Gross Price	
	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
OEM								
Dell	1 30	(1 26,1 33)	1 60	(1 47,1 73)	1 34	(1 25,1 42)	1 25	(0 71,1 8)
Gateway	1 23	(1 06,1 39)	1 22	(1 07,1 38)	0 15	(-0 12,0 42)	0 08	(-0 09,0 25)

[109] Leamer Supplemental Report, 62-66.

[110] Leamer Supplemental Report, 63.

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B. Bundles

89. Dr. Haider alleges that my analysis ignores "substantial evidence on bundled sales and thus, cannot be relied upon for an assessment of how bundling affected pass-through to proposed class members."[111] She argues that my identification of bundles in the data inappropriately excludes products bundled with warranty, tech services, and other accessories.[112] Dr. Haider's arguments are largely misguided and based on a few examples that do not affect my conclusions regarding pass-through in bundled items.

90. Specifically, Dr. Haider claims that she finds sales of bundled items to be prevalent during the proposed class period.[113] Her claim appears to be based on finding some examples in the third-party data and retailer websites, and a testimony by a former Best Buy employee which only includes a list of a few bundles.[114] She does not actually conduct an analysis to determine what share of sales the bundled items accounted for.

91. In my Supplemental Report I discussed the fundamental point that it is appropriate to study pass-through using the entire price and cost of the bundles, which is what I have done in all cases.[115] Dr. Haider did not contest this point. As I also explained, the concern with estimating pass-through for bundles occurs if there are errors in the records of costs associated with the bundle.[116] The latter is a hypothetical, and Dr. Haider did not argue that it occurs in the data analyzed.

92. I also estimated pass-through rates for bundles and for individual items sold separately to explore any differences that might exist. I did not find any

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[111] Haider Report, 60.

[112] Haider Report, 60-63.

[113] Haider Report, 61.

[114] *See e.g.,* Haider Report, 61-63.

[115] Leamer Supplemental Report, 26.

[116] Leamer Supplemental Report, 26-27.

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evidence of a difference in pass-through for bundles and individual items and neither did Dr. Haider.[117]

93. Dr. Haider seems to suggest that all items that are sold with the notebook but not physically attached to it should be counted as a bundle. Pass-through analysis of prices of multiple items sold at the same time should be done item-by-item. While these may be put in the same shopping bag, these are not the kind of bundles for which the issue of bundle pricing arises. I disagree with Dr. Haider's characterization of a "bundle" that is relevant to the pass-through question. The type of bundle that may produce different pass-through rates is a package that is being offered at a lower price than the sum of the individual prices of the items.

94. In particular, Dr. Haider focuses on warranties and tech services "bundled" with the products.[118] However, manufacturer warranties are usually provided as a standard feature of the notebook, e.g., a 1-year limited manufacturer warranty,[119] or an extended warranty is purchased by the customer as an add-on to the product. For example, Dr. Haider points to sales of notebooks with a 2-year warranty in PC Connection data.[120] If the consumer purchased an optional 2-year extended warranty with the laptop, these would be equivalent of separate sales combined into a single transaction. The right way to estimate the pass-through rate for this transaction is to use the entire price and cost of the transaction, which is what I have done in all my regressions. Also, a warranty

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[117] Leamer Supplemental Report, 29.

[118] Haider Report, 59-64.

[119] *See e.g.*, "One (1) Year Standard Limited Warranty for Computers," Toshiba, https://cdgenp01.csd.toshiba.com/content/support/pdf_files/stdwar/gma500875010_revb_web.pdf. *See also*, "Warranty Information," Samsung, http://www.samsung.com/levant/support/warranty/. *See also*, "Acer Limited Warranty Agreement," Acer, https://static.acer.com/up/Resource/Acer/Docs/US/Standard%20Warranty/PanAm-20140218/20140219/Acer_CONS_WTY_DOC_1_YR_MICI_US_CA_MX_LA_46_AD148_008_103113.pdf.

[120] Haider Report, 60.

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that is offered as a standard feature of the notebook is equivalent to any other component of the notebook, in which case the pass-through rates can also be measured using the total price and total cost of the notebook.

95. Finally, Dr. Haider suggests that I ignored information on bundles available in other third-party datasets.[121] I utilized the data I deemed appropriate for identification of bundled and unbundled items that may affect pass-through estimates. The two additional datasets suggested by her, HP and Dell, are not adequate or clear enough to conduct separate analyses of bundles. She points to the HP data in her Table H-13. These data are obtained from the bill of materials and do not show actual bundles sold. For example, under column [c] of that table, it is listed "PRINTER OFFER 1.5C04 CONS US." That seems to suggest that a printer could be purchased with this notebook, but we have no clear indication what if any notebooks were sold in a bundle. In regard to the Dell data, Dr. Haider offers Tables H-1 and H-10. These tables show individuals' customized notebook orders with a base notebook, some physical notebook components (e.g., monitor or battery), and auxiliary items (e.g., warranty, mouse, rebate offer). These could potentially be relevant "bundles" but it is not so clear. The information received from Dell states: "There is not a consistent allocation of revenue on a SKU by SKU or part by part basis because Dell does not sell individual parts; it sells entire orders … [and], in some instances, some value may be attributed to a certain SKU within the order rather than to the base unit."[122] Hence, we don't actually know the prices paid for individual add-on items. In any event, the correct way to study this data is to use the total cost and the total price of the entire order, regardless of whether it is characterized as a "bundle" or not, which is what I have done in my pass-through regressions.

[121] Haider Report, 63-64.

[122] *See* Email from Matthew D. Kent to Attached Service List, Re: In re Lithium Ion Batteries Antitrust Litigation, Case No. 13-md-2420-YGR (DMR), (January 8, 2016).

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VIII. Dr. Haider Is Mistaken That I Did Not Study Battery Cost Pass-Through

A. Dr. Haider Makes an Inappropriate Adjustment to My Battery-Specific Pass-Through Regression

96. Dr. Haider criticizes my pass-through analysis because I (in most cases) studied the relationship between total costs and price. In her words, my pass-through regressions "do not take into account the fact that a cell is but one component of a finished product. They do not isolate the effect of a cell overcharge on the price paid for a finished product from cost increases attributable to any of the numerous other components of the finished product."[123]

97. Dr. Haider provides no justification for why the costs of components need to be broken out to obtain a reliable estimate of pass-though. It is not necessary. First, for a manufacturer, pass-through is not a component issue. Firms make pricing decisions based on total costs or marginal costs that include all components and inputs.[124] That is the reason why the sales records routinely include total costs but not the individual component costs. Manufacturers will pass on cost increases to maximize profits by maintaining the best margin they can. Likewise, they pass on cost decreases to maximize profits (by maintaining or increasing their sales). To a manufacturer, the pass-through decision does not depend on which component increased in price. Accordingly, from an economic standpoint there is no reason to expect different pass-through rates for different components. The fact that I analyzed pass-through on total costs, therefore, is of no concern.

98. Additionally, there was no alternative as the third-party data I had access to generally did not provide component costs. Indeed, Dr. Haider herself has been

[123] Haider Report, 65-68.

[124] *See* e.g., Russell Pittman, "Who Are You Calling Irrational? Marginal Costs, Variable Costs, and the Pricing Practices of Firms," Department of Justice, Antitrust Division (2009).*See also*, Eunsup Shim and Ephraim F. Sudit, "How Manufacturers Price Products," *Management Accounting*, 76 no. 8 (1995).*See also* Haider Deposition, at 245:18-246:1 (When asked whether consumers view price of components or the full price of the item Dr. Haider states that "obviously they [the consumer] see the price of the finished product").

able to point out only a couple of instances where a component-level pass-through was even a possibility and she is mistaken about those. She suggests that, "Even When Relevant Data are Available for Other Intermediaries, [Leamer] Does Not Use Them."[125] She proceeds to point out just two examples, Dell and Acer,[126] both of which are notebook manufacturers and it turns out, both do not provide useable data for component level analysis.

99. It is evident that Dr. Haider has made no effort whatsoever to consider whether the component data available in these two OEMs' productions was actually usable for such analysis. Had she taken a serious look at these datasets, she would have realized their deficiencies. In order for the component cost data to be useful in pass-through analysis, I would need to be able to identify the batteries within the notebooks and match the battery costs to the notebook prices. The Acer component cost data (in the form of battery purchases and BOMs—bill of materials)[127] and notebook sales data were produced separately and they do not allow for adequate matching. As for Dell, the other dataset Dr. Haider points to, it is not adequate for a reliable component-based pass-through regression. The reason is that the Dell sales data contains sales of customized orders with many add-on items. This creates a wide range of prices and total costs for notebooks while the battery type and costs show little variation. In this context, it is difficult to accurately estimate the pass-through of an individual component with such noisy data. Dr. Haider has not studied this dataset and merely points to this as some cost data she sees.[128]

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[125] Haider Report, 72.

[126] "The data provided by Dell contain the cost of a pack broken out separately from costs of other components in their notebook PCs. Similarly, the data provided by Acer also contain the cost of a pack." *See* Haider Report, 73.

[127] For example, AI-LIB000008370-HIGHLY CONFIDENTIAL, ACER-IPP-0000003 CR, ACER-IPP-0000007 CR.

[128] In Dr. Haider's deposition, she stated that she did not conduct any pass-through analysis with this data. *See* Haider Deposition, at 164:4-164:11.

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100. There was one exception—Toshiba—with data that was usable in a component pass-through analysis. I presented component level pass-through analysis for Toshiba in my original report.[129] I analyzed Toshiba's pass-through for battery costs specifically and found a complete positive pass-through.

101. Dr. Haider criticizes my work for not having analyzed the pass-through of other components. Actually, I did, by including other costs in total and estimating pass-through on those components to be 130%.[130] The assumption underlying this regression is that the pass-through rates of all but battery costs are sufficiently similar that it is statistically appropriate to constrain them all to be the same, thus improving the estimate of the battery pass-through.

102. Further disaggregation would only make it more difficult to estimate the battery pass-through accurately, unless the components had very different pass-through rates. We can see this in operation by examining a sequence of regressions. If the regression includes only the total cost, the estimated pass-through rate is 128% and is highly statistically significant. My regression for studying pass-through has two cost variables: batteries and the other costs. The estimated pass-through rate for other costs is 130% but estimated pass-through for battery cost is 88% with a relatively large standard error, meaning the estimate is imprecise. The small increase of the pass-through of other costs from 128% in the first regression to 130% in the second is what allows the decline in the pass-through rate for batteries from 128% to 88%. To confirm that the regression is working to distribute the overall pass-through of 128% among the components, I have re-estimated the battery cost pass-through model with the pass-through rate of other costs set to 100%. Then the estimated battery pass-through becomes 424% and is highly statistically significant. My point is that the higher the estimated rate of pass-through on the other components, the lower the pass-through rate for batteries to achieve the overall rate of 128%. This trade-off is clearly evident in Dr. Haider's regression which includes four cost variables:

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[129] Leamer Opening Report, 74-75.

[130] Leamer Reply Report, 74.

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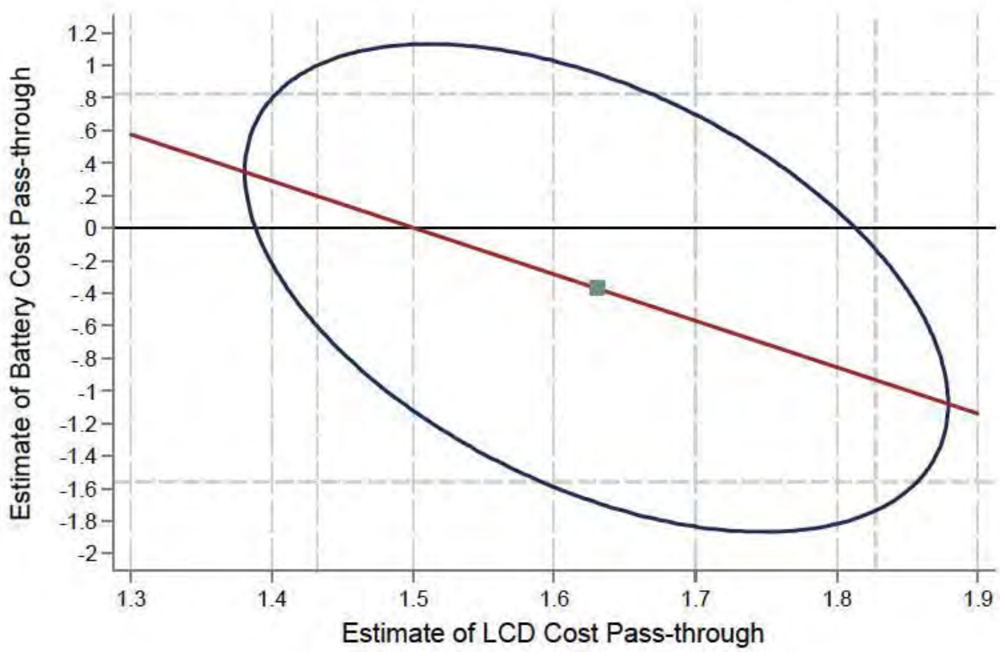
battery, CPU, LCD and other, with corresponding estimated pass-through rates of -37%, 140%, 163% and 116%. Here the very high estimated pass-through rates for the CPU and LCD costs drive the battery estimate into negative territory. But the battery coefficient of -0.37 has a standard error of 0.60, and thus has a 95% confidence interval that extends to 83% pass-through. That's imprecise, not zero. In Figure 24 below, I illustrate my point about the trade-off using the 95% confidence ellipse for the LCD and battery cost coefficients in Dr. Haider's regression. The message is that a positive pass-through estimate for battery cost is associated with a slight lowering of the pass-through rate of the LCD costs from 163% to 150%, along the line in the image representing the estimate of the battery coefficient for a given estimate of the LCD coefficient.

Figure 24

95% Confidence Ellipse for Battery and LCD Pass-through Estimates



103. The bottom line here is that, in totality, the data are clearly compatible with the conclusion that pass-through of battery costs is 100%. These data are not compatible with a pass-through rate of 0%.

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B. Dr. Haider Inappropriately Focuses on Selected Pass-Through Regressions to Assess Injury to Class Members

104. Dr. Haider contends that because a handful of my pass-through regressions have statistically insignificant estimates, it follows that indirect class members who purchased LIB products from these entities were not injured.[131] This comment relates, in particular, to Gateway notebooks and Petra Industries camcorders and power tools. Dr. Haider is wrong on this. As I have written above, imprecision is not the same as zero. This statement is true if there were only a single pass-through estimated, but it increases in importance when there are over a hundred different pass-through rates estimated with only a few of the estimates not statistically significant. With over a hundred regressions some weak or negative results are expected even if the pass-through rate were 100% in every case due to the natural variability of imprecise estimates. Dr. Haider inappropriately chooses to focus on a handful of extreme results and ignore 99.99% of the rest.[132] These pass-through studies should be judged as a whole, which leads to the conclusion of complete positive pass-through of the overcharges to all or almost all class members.

IX. Dr. Haider Misunderstands the Product Design Response to Small Changes in Prices of Components

105. Product redesign could be triggered either by large changes in prices of some of the components or by an across-the-board reduction on total costs. A laptop might have 100 different parts, each initially costing $10, totaling $1,000. A $0.50 reduction in the price of one of the components by itself may not be enough to trigger redesign of this laptop, but that extra $0.50 when added to all the other cost reductions may be enough to trigger a redesign.

106. Dr. Haider does not know whether the rate of redesign of a product is influenced by a change in costs.[133] In fact, she admits in her deposition that she

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[131] Haider Report, 69.

[132] Leamer Supplemental Report, 63.

[133] Haider Deposition, at 204:11-204:24.

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knowns little about when an OEM chooses to redesign a product, as she has "not independently studied … what precipitates a design change."[134] But she agrees that a product could be designed to target a focal point, and was not aware of any literature that cast doubt on the idea.[135]

X. Concluding Comment

107. Dr. Haider has thrown into the discussion a large number of hypothetical problems, most of which reflect a weak understanding of either the relevant economic theory or the relevant econometric theory, or a willingness to ignore the theory to express what some ill-informed persons might think was a genuinely material concern. Since a contest of words between two experts may leave the audience uncertain, a better way for experts to make a point is to provide some economic theory or some data analysis to demonstrate the validity of the expert's thoughts. I have made a very serious effort to back up each and every one of my opinions with supporting evidence. Dr. Haider has not. She has remained in the hypothetical world, with very few exceptions.

108. My tasks, quoted from my Opening Class Certification Report, were two:

> First, I have been asked whether statistical methods common to the class can be used to confirm the existence of economic relationships among prices of lithium ion battery cells and packs such that the effects of the alleged collusion would have been broadly felt.[136]
>
> Second, I have been asked whether statistical methods common to the class can be used to measure the effect

[134] Haider Deposition, at 199:18-204:24.

[135] Haider Deposition, at 198:17-199:2, 199:4-199:14.

[136] Leamer Opening Report, 4.

of the alleged cartel on prices of cylindrical lithium ion battery cells and packs.[137]

109. I offered an affirmative opinion for both of these queries in my first Report. I included theory and persuasive data which together provided strong support for my affirmative answer to both of these queries. The comments on my Opening Report from Ms. Guerin-Calvert and the comments on my Supplemental Report from Dr. Haider have not weakened the evidentiary support for my opinion. On the contrary, I have provided answers to the questions they raised, in the data and in economic and econometric theory. Having found the answers, my opinions have been strengthened, not weakened.

Edward E. Leamer, Ph.D.
November 21, 2017

[137] Leamer Opening Report, 6.

Appendix A. Costs in Notebook Design

Models	PSAD6
SUBS	TAIS
ODM	Compal
Budget P-No	PSAD6U-00S00D
STYLE	FG
2nd HDD	None
Battery	LI 6
Bluetooth	None
Button	6 buttons (CD Play) + Instant DVD
CIR	None
CPU	Pentium T2060 1.60 533-Tj100
Color Variation	Mist Gray
Communication	None
Connector	RJ-11
DVD Region Code	-
Energy Star Label	-
ExpressCard	None
FDD	None
Graphics Controller	ATI RC410MD
HDD	2.5 SATA 100G 5400
Indent	None
KeyBoard	-
LAN	10/100Mbps LAN
LCD	15.4 WX CSV-V
MS-Works	-
MediaBridgeSlot	None
Memory Slot1	DDR2 533 512MB
Memory Slot2	None
Mini-PCI	Atheros 802.11(b/g) 11ch-XB61L
ODD	12.7mm 8x DVD-SuperMulti +-R DL
OS	Win Vista 32bit Home Basic
OS Language	-
Office	-
Pointing Device	Touchpad
Recovery	-
Security	None
Speaker	Standard
Vivace	-
Warranty	-
WinDVD Creator	-
Windows Sticker	Vista Basic Logo

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		2006/4 EMP	2007/Q1 EMP
Exchange Rate		110	110
Architecture Cost		143.38	143.38
MATERIAL		156.4	156.4
System Board - Total		53.05	53.05
10/100Mbps LAN		1	1
DLS10E: 10/100Mbps LAN		1	1
SB1		52.05	52.05
DLS10E: PCBs		8.7	8.7
DLS10E: Audio Chip		0.95	0.95
DLS10E: Keyboard Controller		2.6	2.6
DLS10E: PCMCIA		1.4	1.4
DLS10E: Other Components		15.9	15.9
DLS10E: Chipset		22.5	22.5
Electrical Parts - Total		33.09	33.09
Touchpad		2.46	2.46
DLS10E: Touchpad		2.46	2.46
Standard		1.5	1.5
DLS10E: Standard		1.5	1.5
EP1		29.13	29.13
DLS10E: DC/DC Module		12.48	12.48
DLS10E: Inverter Module		2.51	2.51
DLS10E: Charger		1.5	1.5
DLS10E: Connectors		9.24	9.24
DLS10E: Keyboard		3.4	3.4
Mechanical Parts - Total		28.85	28.85
MP1		28.85	28.85
DLS10E: Cables etc.		3.45	3.45
DLS10E: Plastics		20.7	20.7
DLS10E: Thermal Solution		4.7	4.7
Other Parts - Total		28.15	28.15
LI 4		19.85	19.85
DLS10E: LI 4		19.85	19.85
OP1		8.3	8.3
DLS10E: Modem+Cable		3.3	3.3
DLS10E: AC Adapter+Power Cord		5	5
Miscellaneous - Total		2.5	2.5
Misc1		2.5	2.5
DLS10E: System and K/B BIOS Royality		2	2
DLS10E: Power Quest Royality		0.5	0.5
Other - Total		10.76	10.76
Other1		10.76	10.76
DLS10E: Packing/Label		3.95	3.95
DLS10E: Slik Painting/Logo		0.9	0.9
DLS10E: Painting		3.91	3.91
DLS10E: Manual		2	2
VA1		0	0
CR1		0	0
NON-MATERIAL		-16.49	-16.49
Warranty		9	9
NRE1		5	5
SO1		-25.49	-25.49
Future VA		-5	-5
OA TERM Extention	0.35%	0.55	0.55
TTIP Margin	0.20%	0.32	0.32
Recovery CD		2.6	2.6

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Additional Cost			21.03	21.03
Mini-PCI Atheros 802.11(b/g) 11ch-XB61L			12.57	12.57
Battery LI 6			4.83	4.83
Button 6 buttons (CD Play) + Instant DVD			4.01	4.01
OA TERM Extention		0.35%	0.07	0.07
TTIP Margin		0.20%	0.04	0.04
TAIS shipping			2	2
Warranty for TAIS			-2.5	-2.5
OA TERM Extention		0.35%	0	0
TTIP Margin		0.20%	0	0
CR			0	0
Key Parts - Total			356.35	356.35
MATERIAL			354.4	354.4
Pentium T2060 1.60 533-Tj100			59.4	59.4
15.4 WX CSV-V			110	120
2.5 SATA 100G 5400			90	80
12.7mm 8x DVD-SuperMulti +-R DL			45	45
DDR2 533 512MB			50	50
OA TERM Extention		0.35%	1.24	1.24
TTIP Margin		0.20%	0.71	0.71
MVA1			18	18
Purchase Material Total	$		538.75	538.75

Source: TSB-LIB-00082465_FT_06.23.2015.

Appendix B. Data Provided for Pass-Through Analysis

Pass-Through Analysis Data Summary

Level (1)	Company (2)	Product (3)	Year Coverage (4)	Number of Observations (5)	Sales (6) (million USD)	Number of Models (7)
Packer	[redacted] Taiwan	Notebook	2006-2011	1,621	$ 2,114	25
Packer	[redacted] Dyn to Acer	Notebook	2008-2011	258	229	13
Packer	[redacted] to Dell	Notebook	2007-2011	422	105	10
Packer	Dynapack to Dell	Notebook	2006-2011	454	251	8
OEM	AOpen	Notebook	2002-2010	473	23	85
OEM	Acer	Notebook	1997-2010	6,121	9,145	482
OEM	[redacted]	Power Tool	2006-2011	1,746	348	93
OEM	Bosch	Power Tool	2010-2010	92	1	12
OEM	Canon	Camcorder	2004-2005	314	522	21
OEM	Cornwell	Power Tool	2006-2016	1,535	14	33
OEM	Dell	Notebook	2004-2010	1,573	5,199	75
OEM	Fujitsu	Notebook	2001-2011	56,943	943	33,891
OEM	Gateway	Notebook	1999-2006	515	1,890	177
OEM	HP	Notebook	2003-2009	164	28	51
OEM	JVC	Camcorder	2000-2011	6,388	3,330	517
OEM	Sony	Camcorder	1997-2013	8,942	11,910	442
OEM	Sony	Notebook	2000-2013	221,623	11,314	143,128
OEM	Toshiba	Notebook	1999-2011	237,510	27,848	146,836
Distributor	ASI	Notebook	2001-2011	3,213	106	1,150
Distributor	Ingram	Camcorder	2003-2011	4,843	61	568
Distributor	Ingram	Notebook	2003-2011	66,312	6,577	12,235
Distributor	Petra Industries	Camcorder	2006-2011	80	0	13
Distributor	Petra Industries	Power Tool	2010-2011	50	0	9
Distributor	SED	Notebook	2004-2009	4,586	307	1,447
Retailer	ACE Hardware	Power Tool	2010-2015	1,747	9	61
Retailer	Amazon	Notebook	2007-2008	1,272	61	335
Retailer	B&H	Camcorder	2007-2011	746	110	70
Retailer	Best Buy	Camcorder	2000-2011	1,677	5,142	858
Retailer	Best Buy	Notebook	2000-2011	4,085	30,812	2,857
Retailer	Brandsmart	Camcorder	2001-2006	1,081	15	315
Retailer	Brandsmart	Notebook	2000-2006	4,139	101	1,353
Retailer	CDW	Notebook	2009-2011	21,577	1,333	4,623
Retailer	Circuit City	Camcorder	1997-2009	17,964	4,269	714
Retailer	Circuit City	Notebook	1997-2009	18,905	9,433	1,437
Retailer	CompUSA	Notebook	2001-2007	18,860	11,197	1,612
Retailer	CompuCom	Notebook	1998-2008	22,381	4,062	6,462
Retailer	[redacted]	Notebook	1998-2008	3,747	1,720	1,675
Retailer	Crutchfield	Camcorder	2000-2011	1,682	18	170
Retailer	Fry's	Power Tool	2000-2011	5,215	4	201
Retailer	Home Depot	Power Tool	2009-2012	4,525	18	552
Retailer	Insight	Notebook	2008-2011	34,366	1,172	11,013
Retailer	[redacted]	Camcorder	2008-2011	1,306	6	104
Retailer	[redacted]	Notebook	2008-2011	3,883	382	517
Retailer	Nebraska FM	Notebook	1997-2008	3,661	23	1,202
Retailer	Newegg	Camcorder	2003-2005	1,092	6	150
Retailer	Newegg	Notebook	2002-2005	3,580	120	793
Retailer	PC Connection	Camcorder	2000-2012	6,659	57	887
Retailer	PC Connection	Notebook	2000-2012	73,575	2,076	16,335
Retailer	[redacted]	Camcorder	2007-2015	2,345	5	802
Retailer	[redacted]	Notebook	2007-2015	80,143	1,246	35,458
Retailer	Target	Camcorder	2012-2013	44	1	4
Retailer	Target	Power Tool	2012-2015	39	1	2
Retailer	[redacted]	Camcorder	2009-2016	23,573	9	346
Retailer	[redacted]	Notebook	2009-2016	17,358	10	394
Retailer	[redacted]	Power Tool	2009-2016	2,115	0	40
Retailer	Zones	Notebook	2006-2011	363	5	82
Total				**1,009,483**	**$ 155,690**	**432,745**

Note: (1) 1st and 99th percentile of prices and costs for each product-year removed as outliers.
(2) Transactions removed if notebook price<$100; camcorder price<$20; power tools<$10.
(3) Number of observations is the total number of monthly records for all model codes (annual in case of Best Buy).
(4) Summary of packer data reflects monthly aggregate records for battery packs matched with individual cell prices on capacity, manufacturer, and year-month.

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Exhibit A
List of Additional Materials Relied Upon

Expert Reports	**Date**
Laila Haider	10/24/17

Depositions	
Laila Haider	11/14/17

Publicly Available Materials

“Acer Limited Warranty Agreement,” Acer, https://static.acer.com/up/Resource/Acer/Docs/US/Standard%20Warranty/PanAm-20140218/20140219/Acer_CONS_WTY_DOC_1_YR_MICI_US_CA_MX_LA_46_AD148_008_103113.pdf.

“Dewalt 1/2-in 18-Volt Lithirum Ion (Li-ion) Variable Speed Cordless Hammer Drill,” The Home DepotLowe’s, https://www.lowes.com/pd/DEWALT-1-2-in-18-Volt-Lithium-Ion-Li-ion-Variable-Speed-Cordless-Hammer-Drill/3005497.

“Dewalt DC927KL 18V 13mm Cordless 3 Speed Combi Drill,” TOOLSTOP, http://www.toolstop.co.uk/dewalt-dc927kl-18v-13mm-cordless-3-speed-combi-drill-2-batteries-p6628.

“DeWalt DC927KL 18V Hammer Drill Kit,” Coastal Tool, http://www.coastaltool.com/a/dewalt/dc927kl.htm.

“DeWalt DCD970KL 18V XRP Li-Ion Hammer Drill-Driver Kit,” Costal Tool,” http://www.coastaltool.com/a/dewalt/dcd970kl.htm.

Eunsup Shim and Ephraim F. Sudit, “How Manufacturers Price Products,” *Management Accounting* 76, no.8 (February1995).

Lena Edlund, Laila Haider, and Rohini Pande, “Unmarried Parenthood and Redistributive Politics: Evidence from Europe,” *Journal of the European Economic Association* 3, no.1 (March 2005).

Maria Arbatskaya and Michael R. Baye, “Are Prices ‘Sticky’ Online? Market Structure Effects and Asymmetric Responses to Cost Shocks in Online Mortgage Markets,” *International Journal of Industrial Organization* 22, no.10 (December 2004).

Mark N.K. Saunders, Adrian Thronhill, and Philip Lewis, *Research Methods for Business Students* (Essex: Pearson, 2009).

“One (1) Year Standard Limited Warranty for Computers,” Toshiba, https://cdgenp01.csd.toshiba.com/content/support/pdf_files/stdwar/gma500875010_revb_web.pdf.

Russell Pittman, “Who Are You Calling Irrational? Marginal Costs, Variable Costs, and the Pricing Practices of Firms,” *Department of Justice, Antitrust Division,* No. 200903 (July 2009).

Sergio Meza and K. Sudhir, “Pass-through timing,” *Quantitative Marketing and Economics* 4, no.4 (December 2006).

Sophia Delipalla and Owen O’Donnell, “Estimating tax incidence, market power and market conduct: The European cigarette industry,” *International Journal of Industrial Organization* 19, no.6 (May 2001).

“Warranty Information,” Samsung, http://www.samsung.com/levant/support/warranty/.

Exhibit A
List of Additional Materials Relied Upon

<u>**Data**</u>

Toshiba

TSB-LIB-00082465_FT_06.23.2015

Third Party Data

<u>Acer</u>

ACER-IPP-0000003 CR

<u>Simplo</u>

SIMPLO_TAIWAN_002_HighlyConfidential

EXHIBIT 5

**IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION**

**CONFIDENTIAL – TO BE FILED UNDER SEAL
SUBJECT TO PROTECTIVE ORDER**

IN RE: LITHIUM ION BATTERIES ANTITRUST LITIGATION ______________________________ **THIS DOCUMENT RELATES TO:** **ALL INDIRECT PURCHASER ACTIONS**	**No. 13-MD-02420 YGR (DMR)**

SUPPLEMENTAL EXPERT REPORT OF EDWARD E. LEAMER, PH.D.

September 26, 2017

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I. Assignment and Summary of Conclusions

1. I have been asked by counsel for Class plaintiffs to extend the work in my previous reports[1] with further analysis to:

   a. Estimate pass-through of overcharges for firms that buy LIB cylindrical cells and sell LIB cylindrical packs, including LIB packers that are not party to this litigation;

   b. Address the question of whether rebates, discounts, or bundling by OEMs or retailers would change my opinion on the pass-through of overcharges to consumers;

   c. Address claims that "focal point" pricing might affect whether pass-through of overcharges to consumers occurred; and

   d. Add to or update my pass-through analyses where new or updated data are available.

2. With regard to item (a), using new data on sales price of Simplo and Dynapack LIB packs along with the prices of cells they purchased, I conducted new pass-through regression analyses. I also use defendants' prices of cells sold and prices of packs sold to estimate a pass-through-like regression that measures the relationship between the market for cells and the market for packs. These additional pass-through estimates, like the ones reported earlier, support the conclusion of complete pass-through of the overcharge by packers.

3. With regard to item (b), I explain that the pass-through analyses presented in my previous reports[2] already dealt with bundling in the cases in which bundles were identifiable as distinct items in the business records. In this report, I further elaborate on the effect on the analysis of unidentified rebates, discounts and bundles in the data. Rebates, discounts, and some cases of bundled items can create wrongly recorded prices and costs. Basic statistical theory, however, holds that measurement errors in the costs will tend to reduce the estimates of

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[1] Corrected Expert Report of Edward E. Leamer, Ph.D. February 2, 2016 ("Leamer Report") and Reply Report of Edward E. Leamer, Ph.D. August 23, 2016 ("Leamer Reply Report").

[2] Leamer Report, at Figures 40 – 41 and Leamer Reply Report, at Figures 24 – 27.

pass-through, and measurement errors in the prices will tend to increase the standard error of the pass-through estimates. In other words, these practices only make it harder to detect pass-through in the data. Thus, the fact that there may be unaccounted-for rebates, discounts and bundles in the data means that if we could remedy the problem, the pass-through estimates would tend to go up and be even more "statistically significant." The theoretical results on this issue are confirmed with data sets provided by three retailers that include instant-rebates and one OEM that includes discounts. If the retailer costs are adjusted for the instant rebates, the pass-through estimates become larger. If the OEM sales prices are adjusted for discounts, the pass-through estimates change very little.

4. There is no support in economic theory or in any data that I have explored for the hypothesis that some components of bundles experience zero pass-through, as if these components were given away free. I acknowledge the likelihood that the pass-through of the costs of bundles could be different from the pass-through of the costs of the bundle components sold individually, and I report here estimated pass-through rates for bundles and for selected components of the bundles which are sold separately and individually. In comparing pass-through for bundled and unbundled components, I find no clear differences in pass-through rates for bundles versus pass-through rates for individual products (Figure 10). The lack of a clear difference suggests that the existence of bundling does not shield consumers from being overcharged for components of such bundles.

5. With regard to item (c), I previously explained in my Reply Report why the possibility of "focal point" pricing does not affect my opinion about the pass-through of overcharges. I noted that: 1) there is only weak evidence of "focal points" in the pricing of relevant consumer electronics and considerable scope for prices other than focal points; 2) "free" add-ons can undo "focal point" prices; and 3) quality competition, rather than price competition, would ensure pass-through of "overcharges" in the form of lower quality product for the same price.

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6. In this report, I explain that the economics literature cited by Ms. Guerin-Calvert in support of her focal point hypothesis is concerned with "sticky" prices caused by "menu" costs. "Sticky" prices caused by "menu" costs refers metaphorically to the difficulty of changing the prices charged on a menu due to the printing costs traditionally incurred when restaurants change prices. But in the internet age, with prices of consumer electronics posted online, "menu" costs cannot be assumed to be great enough to cause sticky prices. Indeed, the evidence shows that the prices of consumer electronics change frequently. I offered evidence in Figure 14 in my Reply Report that prices have very short lives. For instance, 30 days following the introduction of Best Buy laptops, 46 percent of sales of new models occur at prices other than the introductory price. Here, I use Best Buy data to determine the age of each product when the first price change occurred, or when the product was removed from the shelves. Fifty percent of prices last less than fifteen days. Seventy-five percent of prices last less than 35 days. In other words, my analysis shows that laptop prices change very soon after the introductory point.

7. Consequently, I reject the idea that prices are meaningfully fixed at focal points. However, introductory prices at Best Buy do seem to be concentrated at focal points. This leaves open the question how there can be pass-through of battery overcharges during the 30-day introductory period when introductory prices are at focal points like $499.99. Put another way, if batteries had been cheaper in the absence of the conspiracy, how would there have been an effect on consumers buying at a focal point price? The answer is quality adjustments (*i.e.*, product design and product redesign). A product designer aware that a laptop will sell at the introductory price of $499.99 must choose a set of components the total cost of which is sufficiently below $499.99 to leave some profit margin along the supply chain. A cheaper battery would allow that product design to include a better battery or an improvement in the quality of some other component of the laptop. In short, a product designer who has a price target and a total cost target will make choices about the price/quality of the battery to meet those price and cost targets. Figure 12 in my Reply Report has the prices of the array of batteries by cell capacity that were available in each year. This illustrates the kind of choice that a product designer must make–a

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better battery can be chosen only if the additional cost is offset by reduced cost of some other component. In this report, I discuss further this design issue with reference to hedonic pricing models used by the Bureau of Labor Statistics to do quality adjusted price indexes for consumer electronics. These hedonic regression models illustrate the kinds of choices that product designers face.

8. By product redesign, I refer to the removal of one model from the retail shelf and replacing it with a new one. A new one can be designed to take advantage of a lower battery price if it occurred. Redesign occurs at a pace determined by the rate of technological innovation that either lowers costs of current features or creates new features. Indeed, the Bureau of Labor Statistics abandoned its traditional hedonic modeling for quality adjustment to laptop prices because the pace of product redesign was too great to allow the hedonic approach to work reliably. Here, I use the Best Buy data to determine the rate of product redesign. In each year from 2000 to 2011, I identify the notebooks and camcorders that were removed from sale, and I compute the age of the product at that point. I find that the median age of the notebooks (at time of removal) varies across years between 75 days and 150 days. Over 95% of notebooks and camcorders were replaced within 24 months. This rapid pace of redesign offers ample opportunity to take advantage of lower battery prices with better batteries or other product improvements. Put another way, changes in battery prices would have been quickly reflected in consumer products through changes in the quality of products sold.

9. I also use HP and Acer laptop sales data to demonstrate the rapid rate of quality improvement (*e.g.*, redesign) for laptops selling at about the same price. I study how the costs and product features changed over time of laptops that sold at prices between $900 and $1,000. The features include monitor size, hard drive size, RAM and so on. The clear and substantial improvement in many of these features of laptops that were selling for about the same price shows how declining costs of the features can translate into improved quality of products sold at the same price. In short, over time, laptops with about the same selling price improved in the quality of their features (*e.g.*, bigger monitors, larger hard drive, etc.).

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10. With regard to item (d), I first refer back to the discussion in my report of the economic theory of pass-through that explains the circumstances in which pass-through of costs can be equal to 100 percent, less than 100 percent, or greater than 100 percent. In this report, I present pass-through analyses for one additional notebook, camcorder, and power tool OEM each (Gateway, Cannon, and Bosch), one additional camcorder and power tool distributor (Petra Industries), and three additional notebook, camcorder, and power tool retailers (Target, Wal-Mart, and Zones). These additional pass-through estimates, like the ones reported earlier, are supportive of a pass-through rate of 100 percent or more. In addition, the evidence is strongly against the hypothesis of zero pass-through. Among my 110 pass-through regression estimates, 105 are "statistically significant" at traditional significance levels, which means statistically strong evidence of pass-through greater than zero. With the support of these 105, the fact that the other five are statistically insignificant should not be interpreted as evidence of zero pass-through for these five cases. The opposite is the case. After all, a positive pass-through can produce a statistically insignificant pass-through estimate if the estimate is statistically inaccurate (large standard error) and/or if the pass-through rate is relatively small. With that fact-of-life, the surprise here is that 105 out of 110 are statistically significant.

11. In sum, the analyses and discussions I present in this report—in conjunction with the economic and econometric evidence presented in my previous reports—support my conclusion that the overcharges on the prices of LIB cells were passed on (all the way through the distribution chain) to Class members.

II. Pass-Through to LIB Packs

12. In my previous reports, I explained that economic theory identifies conditions under which the pass-through could be more or less than 100 percent. However, based on economic theory, in a competitive setting like the consumer electronics markets at issue here, 100 percent pass-through is the predicted result of natural market forces. That should make 100 percent pass-through the conclusion to which we should revert in the absence of evidence to the contrary (the null hypothesis or default). I presented a great deal of

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evidence of the rates of pass-through for various LIB products at different points in the supply chain. These estimates support a pass-through rate of 100 percent or more.

13. In my initial reports, however, I was only able to analyze packer data for non-cylindrical batteries because cylindrical packer data was not available at that time.[3] I therefore relied on documentary evidence to confirm the predictions of economic theory. This evidence included public statements by one packer that it intended to increase pack prices by more than 100 percent of the cell price increase, as well as conspiracy documents showing the defendants discussing pack and cell prices interchangeably, to confirm the predictions of economic theory.[4] Since then, I have received additional data on cylindrical LIB pack prices for two of the largest non-defendant packers – Simplo and Dynapack. I am now able to conduct regression analyses utilizing these data, which provides further support for my initial assessment of pass-through of cell overcharges into the pack prices. I also utilize the defendants' cylindrical cell and pack data in a regression that provides further support for complete pass-through to pack prices.

14. Additionally, I have reviewed more defendant documents that discuss packer pricing and affirm pass-through to packs. I begin with a discussion of these documents. A list of all the documents on which I relied in the preparation of this report (in addition to those identified in my earlier reports) is provided as **Exhibit A**. Should information become available, I reserve the right to update my opinions.

A. Defendant Documents Provide Evidence of Packer Pass-Through

15. Defendants' internal documents provide evidence that the artificially elevated cell prices would be passed on to packs manufactured by non-defendant packers.

[3] Leamer Report, at 26 – 27, Figure 23.

[4] Leamer Reply Report, at 75.

16. <u>Documented Meeting Between Defendants and Packers to Discuss Pack Prices</u>: For example, when LG Chem was "in close cooperation with SMP" (Simplo) it was suggested that, "SMP can raise Q3 pack prices by taking advantage of LG Chem's Q2 cell price increase."[5] In other words, LG Chem's internal communications reveal that LG Chem understood that packer Simplo would raise pack prices following LG Chem's cell price increases. In early 2008, LG Chem held a meeting with Simplo to discuss planned cell price increases. During that meeting, Simplo revealed details of communications with other cell manufacturers and their customers, indicating that "the cell has an increase in March, and the pack increase in April."[6] In short, Simplo told LG Chem that it planned to increase pack prices the month following defendants' cell price increases.

17. There is evidence that when co-conspirators wanted to implement a price increase in 2007-2008, they recognized they would benefit from making packers part of the decision.[7] LG Chem had planned a series of meetings with several packers including Simplo, Dynapack and Celxpert, with the hope of seeing "competitor's moves and customers' reactions more clearly."[8] In one of their meetings with LG Chem, the Taiwanese packers expressed the idea of passing on price increases for cells, stating the cell price could only be raised according to an increase in price of the battery cells.[9] The packers' battery pack prices were tied so closely to the cell prices that they raised the price of the battery packs before the cells, as the packers would not take the burden of the increased cell costs without an offsetting increase of the battery pack price.

18. In another example, Panasonic directly consulted with packer, Simplo Taiwan, and shared details regarding the fixed price increases for cells, which they

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[5] LGC-MDL0000439-0000445 at 441.

[6] LGC-MDL0134692E-013469293E at 692.

[7] LGC-MDL0001692-0001700 at 694, SDI-B-000044026E-000044030E at 027E, and SONY-LIB-000178341-000178346 at 346.

[8] LGC-MDL0134692E-013469293E at 692.

[9] LGC-MDL0001692-0001700 at 695.

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wanted Simplo to propose to Acer and other customers.[10] In another meeting, SDI met with the "Taiwan Packers" Simplo, Celxpert, and Dynapack to express the desire to increase price, which the packers agreed they would also like to do.[11]

19. The cell manufacturers informed the packers of impending price increases and suggested that the packers raise prices in tandem. An internal email exchange revealed that SDI and LG Chem had asked one of their packers to 'cost up' the cell price to finished product manufacturers in anticipation of SDI and LG Chem raising cell prices to the packer. In turn, the packer had requested that they negotiate with HP to try to get the pack price up and if successful, the packer would follow their price increase.[12] Likewise, Sony agreed on a price increase with HP and Asus and indicated it would notify packers, so they could increase prices.[13]

20. Reports of Pass-Through from Cell to Pack Price: Similar evidence described in my previous reports includes a Taiwanese newspaper article circulated between SDI and Panasonic, which indicated that packers were increasing LIB pack prices in response to cell price increases. In some cases, this pack prices were increased by more than 100 percent of the cell price increase: "Driven by the price adjustments of battery [*sic*] cell suppliers, large Taiwanese battery manufacturers have recently officially increased their product sales prices. Even though the relevant insiders were not willing to disclose the actual amount of the price increase, they all said that they not only can they change prices, but they will also increase prices for some models more than those of the battery cells, and prices will continue to rise in the coming months."[14]

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[10] PANA-C000026739-000026741 at 39 ("Panasonic should cooperate SMP and to announce price increase to other customers (SMP will propose)").

[11] SDI-B-000044026E-000044030E at 028E.

[12] SANYO-C000101942-C000101947 at 946.

[13] LGC-MDL0002290-0002299 at 294.

[14] PANA-C000073662E-000073663E at 662.

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21. Defendants Directly Negotiated Pack Prices: Other defendant documents reveal that they often held direct negotiations regarding pricing with buyers of battery packs and that packers seem to have played a minor role in pricing. Put another way, sometimes, defendants themselves negotiated pack prices with pack customers. For example, [redacted][15] Similarly, LG Chem set up a meeting with HP to inform them on a specific amount and timing of battery packs' price increase.[16] LG Chem also received information that SDI had met with Dell, who was considering paying more for a specific cell.[17]

B. The New Packer Price Data Provides Further Support of Pass-Through from Cells into Packs

22. Since filing my initial reports, I have received data containing non-defendant packer sales prices of LIB packs with cylindrical cells sold to OEMs. Specifically, I use the following data: 1) Simplo USA pack sale prices to Dell; 2) Acer purchase prices of LIB packs acquired from Simplo and Dynapack; and 3) Dell purchase prices of LIB packs from Dynapack. I match the prices LIB packers charged to these OEMs with prices charged by defendants to packers for the cells contained in the LIB packs.[18]

23. The price of a pack created by a packer depends on the costs of packing and on the costs of the cells, and also depends on the competitive circumstances under which the battery packs are sold. A battery pack is not a simple cellophane package containing batteries. It's a case with terminals and also an electronics package that controls and monitors the battery function. As a consequence, the price of a pack includes a packing charge. Because the

[15] SONY-LIB-000178341-000178346 at 346.

[16] LGC-MDL0001692-0001700 at 695.

[17] LGC-MDL0001692-0001700 at 693.

[18] This match is performed on a monthly basis by cell manufacturer and cell capacity.

packing charge can vary over time, we should not expect one-for-one month-by-month identical movements in cell prices and pack prices.

24. My examination of LIB price patterns in this data reveals a clear co-movement between cell prices and pack prices, which indicates pass-through by packers. An example of this co-movement is presented in Figure 1 below which illustrates the prices Simplo received for 9-cell packs sold to Dell containing Samsung (top panel) and LG Chem (lower panel) 2600Ah cells and also the prices Simplo paid to Samsung and LG Chem for these cells. The pack price is divided by the number of cells thus making the difference between the pack price per cell and the cell price a measure of the packing margin per cell. If these series moved dollar for dollar up and down, that would support the dual hypothesis of 100 percent pass-through and no change in the packing markup. A prominent feature in all four series is the hill of high prices during the period of elevated cobalt prices discussed in my previous reports. The prices of Samsung 2600mAh cells rose from the beginning of these data series to the peak by about 65 cents while the pack prices rose by about a $1.30. Similarly, the prices of LGC 2600mAh cells rose from the beginning of these data series to the peak by about 83 cents while the pack prices rose by about 73 cents. That is evidence of pass-through, as is the decline in all four series after the peak.

Figure 1

[redacted]

25. Using the new data, I perform a regression analysis of pass-through with a model structure identical to the one I used in my earlier reports to measure pass-through to OEMs, distributors, and retailers.[19] The regression has the quantity-weighted average monthly price of the LIB packs (by cell capacity, cell manufacturer, and number of cells) as the dependent variable which is regressed on the previous month's LIB pack price, monthly quantity-weighted average cell price to the given packer by capacity and manufacturer, and the lagged value of the cell price. As in my previous reports, the regressions are performed with and without product fixed effects.

26. The results are presented in Figure 2 through Figure 4 below. Figure 2 reports a quantity-weighted regression designed to estimate the pass-through of battery costs paid by Simplo onto the pack prices Simplo charged to Dell. The dependent variable is the monthly quantity weighted average of the Simplo pack price divided by the number of cells in the pack, and one explanatory variable is the price that Simplo paid for the cells used in that pack. There are fixed effects for the number of cells which allows the packing margin to be influenced by the number of cells in the pack. In addition, the lagged values of these variables allows for the pass-through to take time to occur. The model is estimated with and without fixed effects for the cell type (capacity and manufacturer). Without the cell-type fixed effects, the pass-through estimate is influenced by the fact that higher-quality higher-priced cells are used in more expensive packs – what is called a cross-sectional correlation. The inclusion of the fixed effects removes this influence on the pass-through estimate, and instead focuses on the comparison over time: pack price increases are correlated with battery price increases. My preference for estimating the pass-through of battery overcharges is the regression with the cell-type fixed effects, thus using the inter-temporal comparisons not the cross-section comparisons. Note that in Figure 2, the two cell price variables are statistically insignificant in the regression without the cell-type fixed effect but the one-month lagged variable is significant in the regression with the fixed effects.

[19] Leamer Report, at 68-73 and Leamer Reply Report, at 69-71.

27. Figure 3 and Figure 4 report regressions with exactly the same structure as the regression in Figure 2. Figure 3 is a regression model that connects the prices that Simplo/Dynapack paid for cells with the prices that Simplo/Dynapack received from Acer for sales of packs. Figure 4 is a regression model that connects the prices that Dynapack paid for cells with the prices that Dynapack received from Dell for sales of packs.

28. The three regressions with fixed effects (*i.e.*, that control for product characteristics) have long-run pass-through estimates equal to 125.5 percent, 90.5 percent and 87 percent. The standard error in each case is large enough so that the estimate is within two standard errors of 100 percent. Thus these regressions are consistent with 100 percent pass-through of cylindrical cells sold by non-defendant packers.

Figure 2: Pass-Through from Simplo to Dell

[redacted]

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Figure 3: Pass-Through from Simplo/Dynapack to Acer

Simplo/Dynapack Battery Pack Prices to Acer vs Cell Prices Charged to Simplo/Dynapack
2008 - 2011

Dependent Variable: Pack Price per Cell by Packer-Capacity-Manufacturer-Number of Cells [1]

	No Fixed Effects				Fixed Effect			
Variable	Estimate	St. Error	T-Value	P-Value	Estimate	St. Error	T-Value	P-Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Pack Price per Cell by Packer-Capacity-Mfr-Num of Cells (-1)	0.7431	0.0537	13.8324	0.0000	0.5588	0.0633	8.8215	0.0000
Cell Price by Capacity and Mfr [2]	0.2738	0.2763	0.9908	0.3231	0.0706	0.2685	0.2629	0.7930
Cell Price by Capacity and Mfr (-1)	0.0642	0.2818	0.2277	0.8201	0.3287	0.2748	1.1964	0.2332
Constant	0.2536	0.1069	2.3733	0.0186	0.8903	0.1584	5.6188	0.0000
Number of Cells Fixed Effects	Yes							
Packer, Cell Capacity, Mfr, Number of Cells Fixed Effects	No				Yes			
Quantity Weights	Yes				Yes			
Long-Run Pass-Through	**1.3152**	**0.1325**	**9.9270**	**0.0000**	**0.9049**	**0.0995**	**9.0971**	**0.0000**
R-square	0.9184				0.9327			
Observations	192				192			

Notes: [1] Per-cell monthly weighted average pack price by packer, cell capacity, manufacturer, and number of cells.
[2] Monthly weighted average price of cell sold to packer by cell capacity and manufacturer.

Figure 4: Pass-Through from Dynapack to Dell

Dynapack Battery Pack Prices to Dell vs Cell Prices Charged to Dynapack
2006 - 2011

Dependent Variable: Pack Price per Cell by Capacity-Manufacturer-Number of Cells [1]

	No Fixed Effects				Fixed Effect			
Variable	Estimate	St. Error	T-Value	P-Value	Estimate	St. Error	T-Value	P-Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Pack Price per Cell by Capacity-Mfr-Num of Cells (-1)	0.4703	0.0555	8.4673	0.0000	0.2620	0.0599	4.3734	0.0000
Cell Price by Capacity and Mfr [2]	0.1757	0.3045	0.5772	0.5642	0.3860	0.2924	1.3198	0.1878
Cell Price by Capacity and Mfr (-1)	0.2601	0.3043	0.8548	0.3933	0.2567	0.2914	0.8808	0.3791
Constant	2.8020	0.3405	8.2289	0.0000	2.4939	0.2655	9.3944	0.0000
Number of Cells Fixed Effects	Yes							
Cell Capacity, Mfr, Number of Cells Fixed Effects	No				Yes			
Quantity Weights	Yes				Yes			
Long-Run Pass-Through	**0.8228**	**0.0928**	**8.8647**	**0.0000**	**0.8708**	**0.0729**	**11.9404**	**0.0000**
R-square	0.7304				0.7737			
Observations	343				343			

Notes: [1] Per-cell monthly weighted average pack price by cell capacity, manufacturer, and number of cells.
[2] Monthly weighted average price of cell sold to packer by cell capacity and manufacturer.

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C. Defendants' Data Offer Additional Evidence of Pass-Through from Cells to Packs

29. The pass-through studies using Simplo and Dynapack data link the cell prices paid by these packers with the pack prices they earned with sales of packs to Acer and Dell. In this section, I report the same kind of regression model using defendant data in Figure 5. This model is a bit different because it links two sales prices: the defendant sales prices of cells and the defendant sales prices of packs. While this model does not purport to track precisely the same goods in terms of input cost and sale price, it accomplishes the same thing by measuring the relationship between the two markets. This variation on the traditional pass-through analysis (which involves purchases and sales of an item by the same business) shows that pass-through is not something chosen by any firm – it's what market competition dictates. Defendants are selling cells and packs into (somewhat) competitive markets. The analysis of the defendants' data is thus relevant for studying the market-determined rate of pass-though.

30. The defendants' transaction data allows me to identify the part number of the cells used in packs sold to various product manufacturers. I was able to determine the prices for cell product numbers that were used in packs for nearly 80 percent of pack sales in the data. I constructed a dataset that matched the prices of the packs with the prices of their component cells.

31. Using this dataset, I perform a regression analysis of pass-through with a model structure identical to the one used in my earlier reports. The regression has the quantity-weighted average monthly price of the LIB packs as the dependent variable. This quantity-weighted average monthly price is regressed on the previous month's pack price, monthly quantity-weighted average price of the component cells sold by the defendants, and the lagged value of this same cell price variable. As in my previous reports, the regressions are estimated with and without product fixed effects. The results are shown in Figure 5. Controlling for product characteristics with fixed effects, this regression measures long-run pass-through at 117.4 percent. In this case the standard error is small enough that the hypothesis of 100 percent pass-through can be rejected at traditional levels of statistical significance. This is evidence of greater than 100 percent pass-through.

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Figure 5

Defendant Pack "Pass-Through" Regressions
1997 - 2013

Dependent Variable: Pack Price per Cell

	No Cell Product Number Fixed Effects				Cell Product Number Fixed Effects			
Variable	Estimate	St. Error	T-Value	P-Value	Estimate	St. Error	T-Value	P-Value
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Pack Price per Cell (-1)	0.9546	0.0028	338.3640	0.0000	0.8426	0.0051	166.0014	0.0000
Price of Cell in Pack	0.1681	0.0097	17.2544	0.0000	0.2204	0.0100	22.0674	0.0000
Price of Cell in Pack (-1)	-0.1096	0.0099	-11.0539	0.0000	-0.0357	0.0104	-3.4460	0.0006
Number of Cells	Yes							
Cell Prod Number Fixed Effects	No				Yes			
Quantity Weights	Yes				Yes			
Long-Run Pass-Through	**1.2872**	**0.0684**	**18.8101**	**0.0000**	**1.1738**	**0.0341**	**34.4257**	**0.0000**
R-square	0.9734				0.9767			
Observations	10,535				10,535			

Note: (1) Dep. Var.: Per-cell monthly weighted average pack price by cell product number.
Ind. Var.: Monthly weighted average price of cell product number within a pack.

32. Another way to detect pass-through and whether such pass-through is driven by market forces is to see whether the prices charged to customers for comparable packs by defendants and by non-defendant packers generally track together. If defendant and non-defendant packer prices generally track together, pass-through driven by market forces is likely to be occurring. If, on the other hand, prices did not generally track together, then pack customers would shift their purchases from one to the other (*e.g.*, buy from non-defendant packers instead of from defendants who sold packs). Figure 6 shows a comparison of battery pack prices charged to Dell by Samsung (a defendant) and Simplo (a non-defendant packer). Specifically, the figure depicts monthly quantity-weighted average per-cell prices of 6-cell battery packs containing 2600mAh Samsung cells. I compute correlation coefficients for each pair of these prices for a product type (defined by the number of cells in the pack, the cell capacity, and the cell manufacturer) and summarize the results in Figure 7 below. There is a high, positive correlation between the prices charged by the defendants and prices charged by packers for the same type of battery pack.

This high, positive correlation suggests that defendant and non-defendant pack prices generally moved together.

Figure 6

[redacted]

Figure 7

Correlations of Packer and Defendant Pack Prices

	Number of Cells in a Pack	Cell Capacity	Cell Manufacturer	Combined Sales (Defendant + Packer) (USD million)	Coefficient of Correlation	T-Statistic	Obs.
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Prices Charged to Dell by Dynapack and Defendants							
1.	6	2600	Samsung	$ 271.48	0.678	5.833	42
2.	6	2200	Samsung	105.46	0.703	4.415	22
3.	6	2200	LGC	50.65	0.472	1.856	14
4.	9	2600	Samsung	49.83	0.804	8.101	38
5.	6	2800	Samsung	47.34	0.586	3.154	21
6.	6	2600	Sanyo	33.32	0.357	0.764	6
7.	9	2800	Samsung	33.22	0.492	2.399	20
8.	6	2600	LGC	13.24	0.593	2.330	12
9.	9	2800	LGC	8.35	0.194	0.625	12
10.	3	2200	Samsung	6.91	0.508	2.040	14
11.	4	2600	Samsung	3.63	0.558	2.607	17
Average Coefficient of Correlation Weighted by Combined Sales:					**0.631**		
Prices Charged to Acer by Simplo and Defendants							
12.	6	2200	Panasonic	245.79	0.966	21.097	34
13.	6	2200	Samsung	84.11	0.673	4.456	26
14.	6	2200	LGC	41.21	0.412	1.196	9
Average Coefficient of Correlation Weighted by Combined Sales:					**0.838**		
Prices Charged to Dell by Simplo and Defendants							
15.	6	2600	Samsung	271.24	0.861	11.231	46
16.	6	2200	Samsung	113.07	0.905	9.508	22
17.	9	2600	Samsung	83.43	0.559	4.468	46
18.	6	2200	LGC	58.23	0.683	3.854	19
19.	6	2800	Samsung	53.14	0.953	17.144	32
20.	6	2800	LGC	43.01	0.849	5.798	15
21.	9	2800	Samsung	28.55	0.915	9.628	20
22.	9	2600	Panasonic	27.74	-0.028	-0.160	35
23.	9	2800	LGC	19.26	0.505	1.942	13
24.	6	2600	LGC	9.26	0.614	2.462	12
25.	6	2200	Panasonic	6.25	0.819	3.499	8
26.	6	2600	Panasonic	1.54	0.201	0.580	10
27.	8	2800	Samsung	0.33	0.952	9.820	12
Average Coefficient of Correlation Weighted by Combined Sales:					**0.777**		

Note: (1) Correlations with minimum number of 6 observations are displayed.
(2) T-statistic = Coefficient of Correlation * sqrt((Obs. - 2) / (1 - (Coefficient of Correlation)^2))

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III. Pass-through for Sales with Rebates, Discounts, and Bundles

33. Rebates, discounts, and bundles are ways that sellers can attract customers by reducing the effective price of an item. Business records at the transaction level are sometimes inaccurate in recording these kinds of price cuts and cost cuts. Discounts which cause errors in the prices are not a great concern, because these discounts reduce the statistical accuracy of the estimated pass-through rate but don't cause either systematic overestimates or systematic underestimates of the pass-through rate. Instant rebates, which can cause unrecorded reductions in the costs, tend to create underestimates of the pass-through rates, not overestimates. In both cases, these errors make it more difficult to find the pass-through that exists. They do not create the impression of pass-through that is not actually there. It is thus doubtful that my studies of pass-through have been materially affected by discounts or rebates. Bundles are not as likely to be incorrectly recorded in the business records, since the price received for the bundle is likely to be accurately recorded and because wise business decision-making depends on the correct measure of the total costs of goods sold to associate with any sales price. It is my understanding that the data I have been working with for power tools where bundling is frequent have the prices and costs of the bundles accurately recorded.

34. Technically, in a model of pass-through that links prices with costs, Price = a + b*Cost, standard econometric theory indicates that additive, random measurement errors in the Cost variable cause downward bias in the estimate of the pass-through rate b, and additive random errors in the Price variable cause no bias in the estimate of b but increase its standard error. While the assumption of additive random measurement error can be disputed with the cost and price data we are studying, these results will have a wider intellectual domain, and could apply to the discounts and rebates studied here. Indeed, they do.

35. With new data sets, I present additional analysis that supports the conclusion that there was pass-through regardless of whether the sale of the LIB cell-containing product involved a rebate, discount, or product bundle. This new evidence also supports the conclusion that – to the extent there were rebates, discounts, or bundled items – the pass-through analyses presented in my

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previous reports[20] would have been unaffected in some instances and in other instances would have underestimated the pass-through.

A. Rebates, Discounts, and Bundles Do Not Affect Pass-Through Conclusions

36. Rebates and discounts are often used at various levels of the distribution chain to stimulate sales or as a price discrimination mechanism to attract price sensitive buyers.[21] In this document, the word "discount" refers to price reductions initiated and financed by the entity that owns the inventory being offered for sale. Rebates are retail discounts paid for by manufacturers. There are two main types of manufacturer rebates. Mail-in rebates are offered to customers who complete and mail in a claim form to receive a post-purchase discount. Alternatively, an instant rebate may be applied at the cash register at the time of the purchase.[22] An instant rebate is equivalent to a mail-in rebate since the manufacturer remits the instant rebate amount to the retailer. It's as if the buyer has paid the full price but gets a rebate instantaneously. In both cases, it is a discount paid by the manufacturer. Where the mail-in and instant rebates may differ is the way they show up in the business records. An instant rebate may be recorded at the reduced price of the transaction, while a mail-in rebate may involve a sales price unadjusted for the rebate, with the rebate possibly recorded after the fact, possibly in a separate record.

37. The ideal data required to measure pass-through are the true sales price and true cost of all transactions, net of any rebates and discounts. Business records may be very accurate about the sales prices of discounted items or items subject to instant rebates but less accurate when there are mail-in rebates. Inaccurate records may lead to either mismeasurement of the prices or mismeasurement of the costs. For reasons discussed above, mismeasurement of the costs is the more serious problem because it probably causes downward

[20] Leamer Report, at Figures 40 – 41 and Leamer Reply Report, at Figures 24 – 27.

[21] Gerstner, Eitan, and James D. Hess, "A Theory of Channel Price Promotions," *The American Economic Review* 81, no. 4 (1991): 872-886.

[22] "Rebates," Federal Trade Commission, https://www.consumer.ftc.gov/articles/0096-rebates.

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bias in the pass-through estimate. Errors in the sales price may only increase the standard error of the pass-through estimate.[23]

B. Data Analysis with Matched Rebates and Discounts

38. Three retailers—Insight, CompuCom, and Zones—provided transaction data matching acquisition cost (price paid to the supplier), retail sales price and manufacturer instant rebates. It is my understanding that for instant rebates the retail price in the record is the amount paid by the buyer net of the instant rebate, which is the correct price. However, the correct cost for a study of pass-through is the net cost (the recorded cost minus the instant rebate). I estimate the pass-through regressions with and without rebate adjustments to the cost to study the effect on pass-through estimates if the costs are not adjusted for the rebates.

39. Additionally, Gateway notebook OEM data contained transaction-specific list prices and transaction-specific discounts. With these data, I can study the effects of omitting discounts on pass-through estimates by estimating pass-through regressions with and without appropriate discount adjustments.

40. Figure 8 provides long-run pass-through estimates and confidence intervals for the three retailers, with and without corrections of costs for rebates. Figure 8 also provides long-run pass-through estimates and confidence intervals using the Gateway OEM data, with and without corrections of sales prices for discounts. The structure of these regressions is the same as other pass-through regressions in my report, including those reported in Figure 2 through Figure

[23] As I explained in my deposition, "[] we're talking about how much pass-through there is of cost in the price. So the ideal thing would be to have the price adjusted for rebates, for bundling. In the case of bundling, it may be that they give us a bundled record in the sale that they don't treat it as two distinct items. If they treat it as two distinct items, then they have to figure out what the prices are. That would contaminate the price data. The rebates will contaminate the price data. [] there's an extensive literature in econometrics on errors and variables that makes a distinction between errors in dependent variables and errors in explanatory variables. In this case, we're at the dependent variables of price, and the explanatory variables is cost. So to the extent that we have measurement errors here the measurement errors are not with regard to cost that you're referring to but rather with regard to price. That's a relatively benign kind of measurement error which makes it more noisy but doesn't necessarily introduce bias." Deposition of Edward E. Leamer, Ph.D., April 26, 2016 at 160:3-161:6 ("Leamer Deposition").

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4.[24] Regressions are again estimated with and without part number fixed effects. As explained above, I prefer the one with the fixed effects because this puts emphasis on changes over time rather than different parts at the same point of time.

41. For the retailers Insight, CompuCom, and Zones, I estimate two regressions, one using acquisition costs ignoring rebates ("gross costs") and the other using acquisition costs minus rebates ("net costs"). These net costs represent the true acquisition costs to these companies. The gross costs regression represents a situation where the rebates are unknown and thus, the true costs have measurement error. As expected in the case of measurement error in the explanatory variable (cost), the less reliable pass-through estimates using gross costs are smaller than the pass-through estimates using actual net costs. The difference in pass-through estimates when gross vs. actual net costs are used supports the conclusion that unobserved rebates cause *underestimates* of pass-through.

42. For Gateway, I conduct a similar exercise for the discounts recorded with the sales transactions. I estimate the regressions with the "net price" (list price minus the discount) paid by the consumer and separately, with prices not adjusted for the discount ("gross price"). Consistent with the econometric theory discussed above the pass-through estimates using gross prices are very close to the pass-through estimates with the correct net prices; this kind of measurement error doesn't create the impression of pass-through that does not exist. This demonstrates that pass-through regressions conducted with data that does not account for discounts would not be materially affected if the actual net prices were available and were used.

[24] As before, I conduct these regressions both with and without product fixed effects. *See* Leamer Report, at 68-73, Figures 40 – 41.

Figure 8: Effect of Rebates and Discounts on Long-Run Pass-Through Estimates

Rebates/Discounts Pass-Through Analysis

	No Part Number Fixed Effects				Part Number Fixed Effects			
	With Rebates/Disounts		Without Rebates/Discounts		With Rebates/Disounts		Without Rebates/Discounts	
	Instant Rebates (Hypothetical Unknown True Cost)							
Company	Net Cost (Gross Cost - Rebates)		Gross Cost		Net Cost (Gross Cost - Rebates)		Gross Cost	
	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Retailers								
Insight	0.9	(0.87,0.92)	0.48	(0.41,0.54)	0.43	(0.41,0.46)	0.23	(0.21,0.26)
CompuCom	0.88	(0.86,0.9)	0.63	(0.61,0.65)	0.8	(0.78,0.82)	0.58	(0.56,0.6)
Zones	1.11	(1.08,1.14)	0.95	(0.85,1.05)	0.93	(0.73,1.12)	0.54	(0.16,0.91)
	Discounts (Hypothetical Unknown True Price)							
	Net Price (Gross Price - Discount)		Gross Price		Net Price (Gross Price - Discount)		Gross Price	
	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
OEM								
Gateway	1.23	(1.06,1.39)	1.22	(1.07,1.38)	0.15	(-0.12,0.42)	0.08	(-0.09,0.25)

C. Bundled Items

43. Bundling refers to a retailer practice of selling multiple products combined into one product bundle. For example, a pack of memory cards may be offered in a bundle with a digital camera or a photo printer may be offered in a bundle with a notebook. The bundles identified in the third-party data discussed below consist, for example, of combinations such as notebooks and accessories (keyboard, mouse, mouse pads), camcorders and photo-printing paper, or camcorders and printers.

44. Bundles are often sold at a lower price than the total of the individual component items.[25] From the seller's perspective, bundling may provide an opportunity to liquidate less sought-after inventories by packaging them with more highly demanded products. Bundles could also be a way to create demand for accessories when they are combined with the main item.[26]

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[25] *See* Janiszewski, Chris, and Marcus Cunha Jr., "The Influence of Price Discount Framing on the Evaluation of a Product Bundle," Journal of Consumer Research 30, no. 4 (2004): 534-546.

[26] *See* Derdenger, Timothy and Vineet Kumar, "The Dynamic Effects of Bundling as a Product Strategy," Marketing Science, no. 6 (2013): 827-859. The authors examine the handheld video game market, and find

45. A pass-through regression works best if the prices and costs that are used to estimate the equation are perfectly accurate. Bundling has the potential for causing errors in prices or costs or both which might affect the pass-through estimates I have reported. A data analysis could use the components of the bundle as the unit of observation if the prices and costs of the components were known and if the bundle were sold for the sum of the prices of the components. But if a bundle is sold for less than the sum of the known sales prices of the components, and if the analysis were to use the components as the unit of observation, then there are two choices for determining the component price: the overall price discount would have to be distributed across all the components or concentrated on only one component. Either choice involves potential mismeasurement of the prices of the components.

46. Alternatively, the bundle could be the unit of observation for a study of how the total cost of the bundle is passed on to the price of the bundle. This would work perfectly provided that the bundle price and the bundle cost are accurately measured. The right cost to associate with the sale of a bundle sold at a known price is the sum of the costs of all the items in the bundle. It is my understanding that this is the way the costs are recorded in the power tools datasets I have studied, and there is consequently no error in my earlier analysis of power tool bundles.

47. Some businesses may make the accounting error of measuring the cost-of-goods-sold applicable to a bundle by including the cost of only one of the items, or only a subset. Consequently, the business records would have costs that are too low for the bundled items. Since the costs are too low, the pass-through estimate associated with these mistaken costs might be higher than the pass-through estimate would be if the correct data were used. However, the econometric theory concerning the size and direction of the bias in the pass-through estimate caused by this kind of error in the costs is not clear cut – depending on the nature of the measurement error, the pass-through estimate could be either too low or even too high or neither. If, for example, we were

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that "bundling enhances revenues for both hardware and software."

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estimating the equation Price = a +b*Cost, but the true cost is equal to the measured cost plus the same fixed amount for every bundle, then this measurement error would only affect the estimate of the intercept "a" and would leave the estimate of the pass-through rate "b" unaffected. This fixed understatement of the cost would occur if all laptops came bundled with the same additional product with the same costs, or laptops were bundled with different additional products all of which had about the same cost.

48. This concern appears to be theoretical only. I have not actually identified any examples of this kind of accounting error, nor have the defendants produced any. For prudent business decision-making, firms have an incentive to keep accurate records. Absent evidence to the contrary, I am inclined to treat the costs and prices in the datasets I have studied as accurate for bundles as well as for unbundled sales.

49. In addition, the impact that bundling might have on the pass-through estimates depends on the prevalence bundled sales. Several retailers, including Crutchfield, Insight, and PC Connection, provided detailed descriptions of the items in each bundle, which allows me to identify in their records both the individual sales and the bundled sales.[27] Figure 9 presents the results of this analysis. It shows the negligible contribution of bundles to total sales in notebook and camcorder categories (see "Bundled Quantity Sold Share" column). Among these third-party vendors and product types, bundles account for less than one percent of all sales. This amount of bundling is highly unlikely to materially affect pass-through estimates.

50. Power tool is the only category that has a substantial share of bundled items in the form of power tool kits (*e.g.*, drill and impact kits). However, it is my understanding that the cost measures applicable to these bundles include both the drills and the other bundled items, in which case prices and costs are correctly measured, and consequently my previous pass-through regressions for power tools use these price and costs data are completely appropriate.

[27] Bundles are identified in the data through the presence of the word "bundle," or an abbreviation of the word, in the product description.

Figure 9

Bundles as a Share of Sales for Third Parties Offering Bundles

	Product Type	Company	Level	Bundle Quantity Sold	Individual Item Quantity Sold	Bundle Quantity Sold Share	Individual Item Quantity Sold Share
	(3)	(1)	(2)	(4)	(5)	(6)	(7)
1	Camcorder	Crutchfield	Retailer	99	29,928	0 33 %	99 67 %
2	Camcorder	Ingram	Distributor	1,339	194,488	0 68 %	99 32 %
3	Camcorder	PC Connection	Retailer	76	151,901	0 05 %	99 95 %
4	Notebook	Insight	Retailer	468	1,040,069	0 04 %	99 96 %
5	Notebook	PC Connection	Retailer	9,296	1,629,217	0 57 %	99 43 %
6	Power Tool	ACE Hardware	Retailer	29,819	44,634	40 05 %	59 95 %
7	Power Tool	[redacted]	OEM	954,158	768,023	55 40 %	44 60 %
8	Power Tool	Cornwell	OEM	45,869	13,819	76 85 %	23 15 %
9	Power Tool	Fry's	Retailer	7,479	98,154	7 08 %	92 92 %
10	Power Tool	Home Depot	Retailer	74,366	50,916	59 36 %	40 64 %
11	Power Tool	Petra Industries	Distributor	255	69	78 70 %	21 30 %

Note: (1) Item descriptions are used to differentiate sales of bundled items from sales of individual items.

51. With the right data set we could study the pass-through of the cost of each component onto the price of the bundle with a regression that explains the price of the bundle as function of each of the separate component costs, not just the sum of the costs. However, the data we have on bundled products do not come with costs of each of the components of the bundle, so this calculation is not feasible.

52. The defendants have raised the bundling point to suggest that for some of the components of the bundle the pass-through rate might be zero. The short-comings of the business records that make it difficult to disprove this hypothesis should not be regarded as evidence that this is true. On the contrary, the zero percent pass-through hypothesis that the costs of some of the components do not influence the makeup of the bundle and the pricing of the bundle cannot be taken seriously. When a bundle is created and priced, the costs of all of the items should be a consideration, and treating some of the components as if they were "free" would lead to bundles that would create losses for the sellers.

53. I acknowledge that the pricing of a bundle is likely different from the pricing of the components and the pass-through rates are likely different. The usual optimal markup rule has price equal to cost times a factor equal to or greater than one that depends on the elasticity of demand. An inelastic demand has the feature that an increase in price has little impact on the volume of sales. An inelastic demand means "pricing power" and a high markup. It could be that bundles attract shoppers who are particularly price sensitive, in which case the bundle markup would be less than the component markup.

54. The difference between pass-through of bundle costs and pass-through of component costs can be studied using data sets that include both sales of bundles and also separate sales of the components of the bundles. Figure 10 reports estimated pass-through rates for notebooks and power tools sold in bundles and the same items sold alone. The top panel has regressions estimated without product number fixed effects and the bottom panel has regressions estimated with product number fixed effects. For bundles, the pass-through refers to total costs while for individual items it is only the cost of the item.

55. Out of 10 regressions estimated for power tools bundles, nine pass-through estimates are positive and statistically significant. The other case has a very wide confidence interval because the data are not adequate for precise estimation. Nine out of 10 regressions for individually sold power tools are positive and statistically significant and the one negative has a confidence interval that suggests the pass-through rate is low. For notebooks, all estimates for bundles and non-bundles are positive and statistically significant. This is evidence that pass-through also occurs in the bundled items. There does not seem to be any consistent ordering of the pass-through rates for bundles and for individual items.

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Figure 10: Bundle Pass-Through Regressions

No Part Number Fixed Effects

		Bundles				Individual Items			
		Notebook		Power Tools		Notebook		Power Tools	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(7)	(8)
OEM	[redacted]			93 %	(73%,113%)			125 %	(114%,135%)
OEM	Cornwell			101 %	(96%,106%)			122 %	(120%,123%)
Retailer	ACE Hardware			98 %	(84%,112%)			108 %	(102%,114%)
Retailer	Fry's			93 %	(80%,105%)			53 %	(35%,72%)
Retailer	Home Depot			114 %	(110%,118%)			99 %	(96%,102%)
Retailer	Insight	85 %	(74%,95%)			90 %	(87%,92%)		
Retailer	PC Connection	106 %	(96%,116%)			91 %	(90%,91%)		

Part Number Fixed Effects

		Bundles				Individual Items			
		Notebook		Power Tools		Notebook		Power Tools	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(7)	(8)
OEM	[redacted]			180 %	(80%,279%)			39 %	(9%,69%)
OEM	Cornwell			98 %	(81%,115%)			64 %	(48%,80%)
Retailer	ACE Hardware			44 %	(31%,58%)			41 %	(34%,48%)
Retailer	Fry's			(14)%	(-109%,81%)			149 %	(107%,191%)
Retailer	Home Depot			74 %	(57%,91%)			(4)%	(-21%,13%)
Retailer	Insight	-	-			43 %	(41%,46%)		
Retailer	PC Connection	86 %	(64%,108%)			96 %	(96%,97%)		

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1).
(2) Long-Run Pass-Through estimates are presented.
(3) Based on monthly average prices and costs by manufacturer part number or SKU.
(4) Quantity weighted regressions.
(5) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(6) Notebook regressions include an indicator for Netbooks where applicable.
(7) Camcorders are excluded from the analysis due to insufficient data to estimate the Fixed Effects model.
(8) The following companies are excluded from the analysis due to insufficient data for:
Bundle data for Ingram and MEI, Individual Item data for Petra Industries, and Bundle data for Notebooks in Fixed Effect model.

IV. Pass-through in the Presence of Focal Point Pricing

56. In my Reply Report, I addressed the claim in the Guerin-Calvert Report[28] that a "focal point" pricing strategy may preclude the pass-through of battery overcharges to final product prices.[29]

[28] Expert Report of Margaret Guerin-Calvert, May 24, 2016 ("Guerin-Calvert Report").

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57. First, I showed that there is no convincing evidence of prevailing "focal points" in the pricing of relevant consumer electronics. In particular, I showed that 1) retailers offer a wide range of product options at a variety of "non-focal" prices;[30] 2) even products introduced at so-called "focal" point prices ending in 9 experience price changes soon after the introduction;[31] and 3) "free" add-ons can lower the effective price of items ostensibly sold at "focal point" prices.[32]

58. I also discussed how quality competition, rather than price competition, would ensure pass-through of overcharges in the form of lower quality product for the same price. In particular, I described how manufacturers can design a product suited to sales at the introductory focal point by choosing from the wide range of quality of components, such as LIBs. When the battery prices were elevated by the illegal conspiracy, product designers would have to cut quality in order to sell at the focal point. The damages then are the monetized value of that decline in quality.

59. In this report, I discuss a variety of additional issues relating to focal point pricing that make it highly unlikely that focal point pricing would keep inflated battery cell prices from being passed through to consumers. First, the academic literature cited by Ms. Guerin-Calvert refers to "sticky" prices, not to focal points. According to this literature, prices stay fixed because of the "menu" costs of changing prices on *printed* menus. But with prices advertised on the internet, the costs of changing prices are extremely small, and with machine learning and the use of artificial intelligence, price changes can be fully automated. Ms. Guerin-Calvert in paragraph 79 of her report hypothesizes focal price points for a camera at $199.99 and at $219.99 and suggests that small increases in costs would not be result in a jump from $199.99 to

[29] Leamer Reply Report, at 50 – 58.

[30] Leamer Reply Report, at 51 – 53.

[31] Leamer Reply Report, at 57.

[32] Leamer Reply Report, at 56.

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$219.99.[33] That suggests a very coarse set of prices that firms can choose from. Her exhibit 4 of actual prices however masks the actual variability of Best Buy Notebook prices by reporting only the summary statistics: mode, mean, and median, all for the very same Gateway notebook, all on the same day or the same month. In contrast to what Ms. Guerin-Calvert suggests, I find "fuzzy" focal points in Best Buy retail price data for notebook computers – there are overrepresented prices $499.99, but many notebooks are advertised at non-focal prices and many notebooks are listed as "on sale."

60. I explain again that fixed focal points turn price competition into quality competition, and declining prices for parts like batteries do not affect the focal point prices but do affect the kind of product sold at those prices. Buyers are harmed not because they pay more but because they get less.

A. Quality Adjusted Prices for Consumer Electronics

61. An understanding of the powerful role of quality changes in this industry begins with a look at the basic price trends. According to data compiled by the Bureau of Labor Statistics ("BLS"), prices of notebooks have been falling at rates exceeding ten percent per year since 2005. How is that sharply declining price compatible with the focal point of $499.99? The answer is that the BLS price is "quality adjusted." A quality adjusted price answers the question – how much would it have cost in 2014 to buy a laptop with the same set of features as one sold in 2013 at the focal point of $499.99, *i.e.*, the same RAM, the same hard drive size, the same screen characteristics, the same processor speed and so on. If the answer in 2014 is $425, that represents a fifteen percent ($75) reduction in the quality adjusted price from 2013 to 2014. Thus, the persistent decline in BLS estimates of the prices of notebooks is more a consequence of the very significant quality improvements than price declines for the same product over time.

62. The BLS performs quality adjustment via "hedonic modeling" in which the product price data are explained by an estimated model with price as the

[33] Guerin-Calvert Report, at 36.

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dependent variable and product features as the explanatory variables. I report below the hedonic model that the BLS used for quality adjustment of prices of portable computers. This hedonic model helps illustrate relevant product design issues since it identifies sets of notebook features that would allow the notebook to sell for a focal point like $499.99. In addition, it is critical that the BLS abandoned this method of quality adjustment "**[b]ecause the individual components in PC configurations change so rapidly**."[34] I put these words in bold because they confirm the very rapid rate of technological advance in portable computers and the need for product design to keep pace with this competitive reality in order to continue to sell at any focal point.

63. Armed with the knowledge that this industry has experienced very large improvements in quality and very substantial declines in quality-adjusted prices, we can address the basic question: how do focal points affect pass-through of battery prices? The answer is: hardly at all, for two reasons. First, the quality-adjusted introductory prices of new products sold at focal points will be lower if battery prices are lower (*i.e.*, even if the actual price is not lower, the quality adjusted price is lower). This lower quality-adjusted price is a result of product designers responding to lower battery prices with better batteries and/or improvements in other features, thereby still selling the product at the same focal point. In other words, pass-through at product introduction is not affected by focal points because of quality adjustments to the product itself.

64. The second reason that focal points do not matter much is that the introductory focal point prices don't last very long, either because a sale occurs, or because the product is removed from the shelves and replaced with a new design that embodies the new costs. Depending on the shelf-life of a focal price, product designers need to worry about product cost not just at the day of introduction but also somewhat later when costs may be different but the focal point still applies. This concern is greatly reduced since, as is shown below, the shelf-life of focal prices is short, generally under a year, because products go on

[34] "How BLS Measures Price Change for Personal Computers and Peripheral Equipment in the Consumer Price Index," Bureau of Labor Statistics, https://www.bls.gov/cpi/cpifaccomp.htm.

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sale and because products are rapidly phased out, and replaced with new designs.

65. Product pricing and product design in pursuit of profits depend on all costs, not just battery costs. In the actual world, the cost associated with any configuration of product features is probably descending at a fairly constant rate, and the more rapid decline in battery prices in the but-for world would increase that rate of descent. Either product prices would be lower or product quality higher in the but-for world (in which battery prices were lower in the absence of collusion).

B. Are Consumer Electronic Prices "Sticky"?

1. *"Menu Costs" Can Make Prices Sticky*

66. Although the defendants have not clearly stated their "focal point" hypothesis, the two references (Goldberg and Hellerstein (2007) and Hyde (2016)) in footnote 84 on page 35 of Ms. Guerin-Calvert's expert report refer to "sticky prices" and "menu" costs but make no reference to the words "focal points."[35] In other words, the sources for Ms. Guerin-Calvert's focal point analysis do not even mention "focal points."

67. The economics literature uses the phrase "menu costs" to suggest that restaurants that print menus will stick with their prices in the face of small changes in food costs because it is costly for them to print a new set of menus. The classic example of sticky prices discussed in the second paragraph of Hyde (2016) is Coke: "Some products are sold at the same price for ages, including the famous example of the 6.5 oz. bottle of Coke that cost 5¢ for decades, a price streak that persisted through the Great Depression and two world wars."[36]

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[35] Guerin-Calvert Report, at 35.

[36] Tim Hyde, "Prices are sticky – but does it matter? New evidence that menu costs do hold firms back," *American Economic Association*, March 7, 2016, accessed September 9, 2017.

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Mike Fisher/Flickr

68. If batteries were to consumer goods, as sugar was to Coke, I would agree that there would be no pass-through of small changes of battery prices to final goods prices. But the explanations for the fixed price of Coke offered by a National Public Radio segment don't apply to modern consumer electronics. Per NPR,[37] it was a legal contract that fixed the price of Coke early in the Coke fixed price period. Later, it was a prodigious amount of advertising that committed to the five cent price, not just printed on paper but painted on signs like the one displayed above. Later still, Coke was sold via half a million vending machines which would have had to be retooled to allow a coin different from a nickel. For Coke, the menu costs of changing this price were very large.

69. Unlike the Coca-Cola example, in the 21st Century with prices of consumer electronics advertised on websites, a new price can be created with a couple of strokes on a computer keypad, making "menu costs" a poor explanation of sticky prices.

[37] NPR offers an explanation for the Coke permanent price: "Prices go up. Occasionally, prices go down. But for 70 years, the price of a bottle of Coca-Cola didn't change. From 1886 until the late 1950s, a bottle of Coke cost a nickel. On today's show, we find out why. The answer includes a half a million vending machines, a 7.5 cent coin, and a company president who just wanted to get a couple lawyers out of his office." "Episode 416: Why The Price of Coke Didn't Change For 70 Years," *NPR Planet Money*, Podcast audio November 18, 2015, http://www.npr.org/sections/money/2015/11/18/456410327/episode-416-why-the-price-of-coke-didnt-change-for-70-years.

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2. *Retailers Use "Fuzzy Focal Points" Which May Be Designed to Help Consumer Shopping*

70. On September 14, 2017, the Best Buy website advertised 789 laptops ranging in price from $149.00 to $8,999.99.[38] How might a shopper choose from this vast array of alternatives? Some shoppers might first ask themselves how much they would be willing to pay for a new laptop. A hypothetical answer would be $500 and maybe as much as $600. These shoppers might then compare laptops that cost about $500, and they might contrast the best of them with what $600 could buy. Knowing how consumers shop, Best Buy might want to cluster prices around $500 and $600.

71. On that September 14 day, the Best Buy website advertised 203 laptops ranging in price from $250 to $499.99. There were 15 products listed for $499.99, including one that was marked down from $599.99, and three advertised as "Refurbished." The prices of the 61 laptops with prices from $399.99 to $499.99 are illustrated in Figure 11. In addition to overrepresentation of the prices $499.99 and $399.99 with 15 and 16 laptops respectively, there were six laptops at 449.99 and four at 496.99. These four prices might be called focal points, but there is a lot of scope for variation in these Best Buy prices. Just below the $499.99 focal point, four laptops were advertised for $496.99 and one was $493.99. In other words, Figure 11 shows some overrepresentation at the $499.99 and $399.99 level, but many prices at other levels as well.

72. There is evidence of price changes on the website as well. Nineteen of the advertised prices of the 61 laptops between $399.99 and $499.99 were listed as "Previously" some other price. Thus, the four overrepresented prices in Figure 11 are what might be called "fuzzy focal points." They were overrepresented, but not the only prices available.

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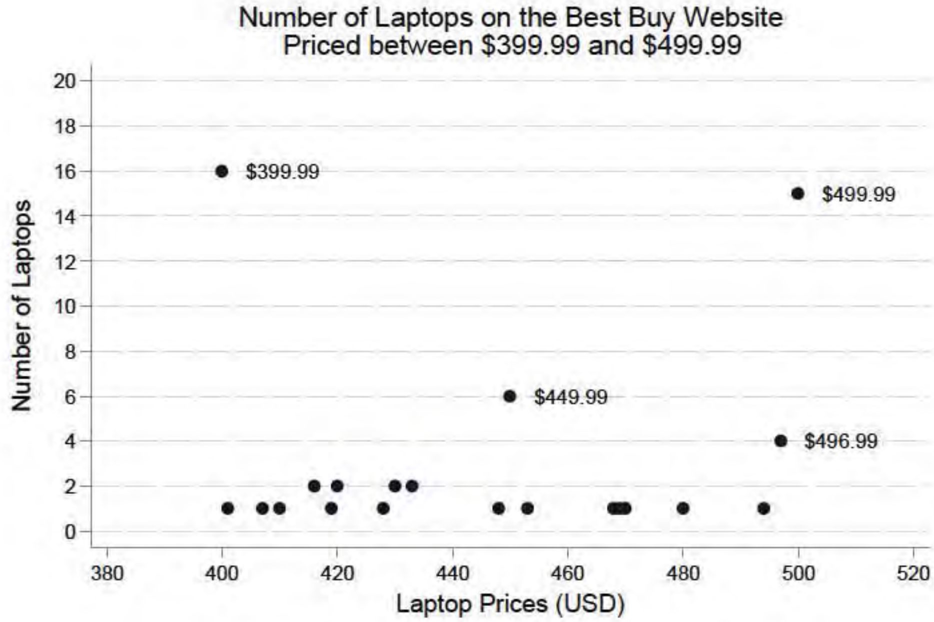
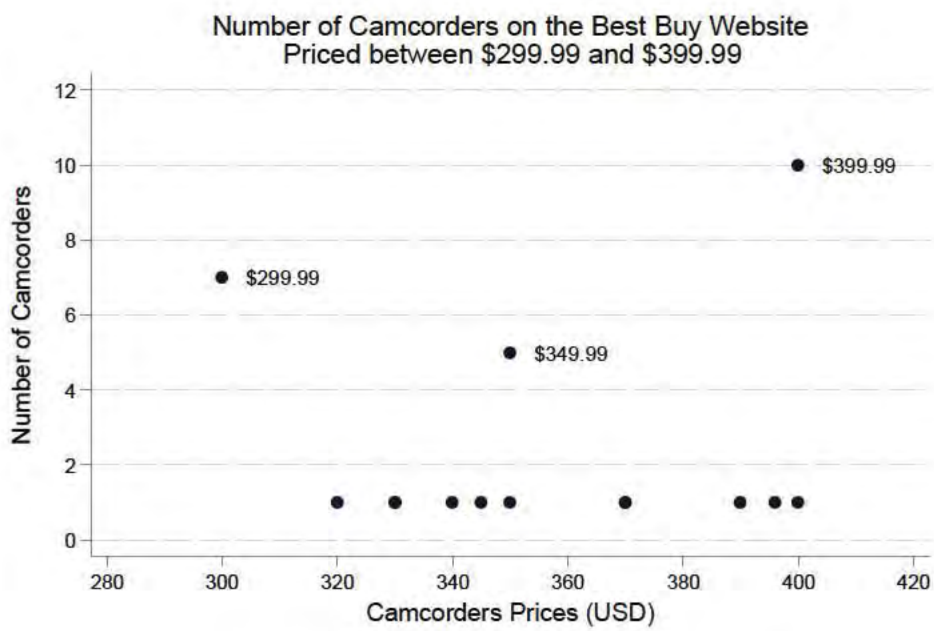
[38] Data accessed from "All Laptops," Best Buy, accessed September 14, 2017, https://www.bestbuy.com/site/laptop-computers/all-laptops/pcmcat138500050001.c?id=pcmcat138500050001. See Backup.

Figure 11



Source: Best Buy Website (Accessed September 14, 2017)

Figure 12



Source: Best Buy Website (Accessed September 14, 2017)

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73. On September 14, 2017, the Best Buy website advertised 104 camcorders ranging in price from $75.99 to $4,499.99.39. There were 52 camcorders ranging in price from $199.99 to $399.99. There were 10 products listed for $399.99, including one that was marked down from $499.99. The prices of the 33 camcorders with prices from $299.99 to $399.99 are illustrated in Figure 12. In addition to overrepresentation of the prices $299.99 and $399.99 with 7 and 10 camcorders respectively, there were five camcorders at $349.99. These three prices might be called focal points, but there is a lot of scope for variation in these Best Buy prices. Just below the $399.99 focal point, one camcorder was advertised for $399.96 and one was $395.99.

74. There is evidence of price changes on the website as well. Seven of the advertised prices of the 33 camcorders between $299.99 and $399.99 were listed as "Previously" some other price. Thus, the three overrepresented prices in Figure 12 are fuzzy focal points.

C. Laptop Design and Quality Adjusted Producer Prices

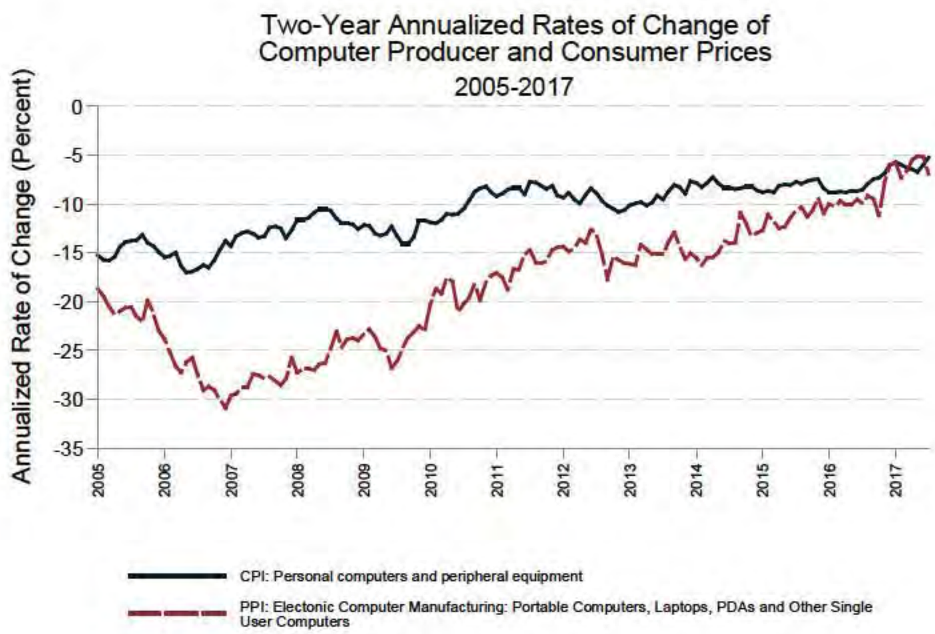
1. Prices of Consumer Electronics Are Not "Sticky": They Decline at Rates of More Than Ten Per Cent Per Year

75. While sticky prices may occur in some settings because of menu costs, selling of consumer electronics goods is not an environment in which prices can be held fixed for very long. Figure 13 illustrates the rates of change of "factory gate" wholesale prices of portable computers, laptops, PDAs and other single user computers (Producer Price Index) and also that of retail prices of personal computers and peripheral equipment (Consumer Price Index). At the beginning of 2007, wholesale prices were declining at a rate of 30 percent per year, and retail prices were declining at a rate of 14 percent per year. Since then there has been some abatement in those rates of decline but by the beginning of 2016, the wholesale prices were still falling at the rate of ten percent per year and retail prices were declining at the rate of nine percent per year. There

[39] Data accessed from "All Camcorders," Best Buy, accessed September 14, 2017, https://www.bestbuy.com/site/camcorders/all-camcorders/pcmcat186400050003.c?id=pcmcat186400050003. See Backup.

cannot be product prices that are fixed for very long in this competitive environment. However, these are quality adjusted prices which allows the selling prices to be constant while the quality improves. More on this next.

Figure 13



Source: U.S. Bureau of Labor Statistics/FRED

2. *Hedonic Models Illustrate How Product Design Can Support Focal Point Pricing*

76. The U.S. Bureau of Labor Statistics (BLS) routinely used hedonic regressions to construct quality-adjusted prices for consumer electronics.[40] A document on the website of the Bureau of Labor Statistics[41] titled "Hedonic Models in the Producer Price Index (PPI)" dated June 2011 reports the "hedonic model regression results" reproduced in Figure 14.[42] This is an estimated equation

[40] "Hedonic Models in the Producer Price Index (PPI)," Bureau of Labor Statistics, https://www.bls.gov/ppi/ppicomqa.htm.

[41] Ibid.

[42] Griliches (1988) stated that "...one might use regression techniques to relate the prices of different models or versions of a commodity to differences in their characteristics, qualities, and discover thereby the relative valuation of such qualities is reasonably obvious." Zvi Griliches, "Hedonic Price Indexes and the

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that explains the manufacturers' (wholesale) prices of 3,360 laptop computers as a function of their characteristics such as memory, hard-drive, processor speed, and number of battery cells. The coefficients in this estimated equation measure the revealed (or hedonic) value of the features. For example, the coefficient on RAM equal to 48.661 indicates that laptops with greater memory tend to sell at higher prices, roughly $48.66 per GB of memory. Replacing a six-cell battery with a nine-cell battery adds $69 to the hedonic value.

77. The purpose of this regression for the BLS is to adjust prices of notebooks for changes in quality over time. A hedonic model is estimated using data for one year, for example. This establishes the values of the characteristics at that time. The next year when a new model comes out with new features like a better battery, the hedonic model allows one to determine what a model with these new features would have sold for the year before. The difference between the actual price (*e.g.*, $499.99) and the predicted hedonic price (*e.g.*, $550.00) is a measure of the effective price reduction (10 percent) over time.

78. I use this display to suggest the kind of product design issues that confront producers expecting to sell laptops at fixed focal points. This is an equation that would allow a designer to determine the potential sales value of laptops that had certain features: processor speed, GB of RAM, GB of hard drive and so on. Using this equation, a particular set of features could be found that would form a laptop that would sell for the focal point, $499.99. Starting there, a designer could explore what changes in features would maintain the price at $499.99. The equation suggests that each 100 GB of hard drive would add $45 (standard error: $1) to the value while a reduction of 1 GB of RAM would cut the value by $48.66 (standard error: $1.1). Thus, a laptop that had 1 GB more RAM but 100 GB less hard drive would sell for about the same price. In other words, there are many alternative designs that could be sold at the same focal point. Not all of these are equally attractive to customers. Here's the point: When the price is fixed at a focal point, quality competition (product design)

Measurement of Capital and Productivity: Some Historical Reflections," in *Fifty Years of Economic Measurement: The Jubilee of the Conference on Research in Income and Wealth*, eds. Berndt, Ernst R., and Jack E. Triplett. (University of Chicago Press, 1991), 185.

replaces price competition. When the costs of the features decline over time, the products designers can build products with better features and still sell at the same price.

Figure 14

Table 3. Hedonic Model Regression Results for Laptop Computers for the PPI

	Coefficients	Standard Error	T-statistic	P-value
Constant	-393.067	36.192	-10.860	0.000
Core i per GHz	456.044	14.020	32.528	0.000
Memory per GB	48.661	1.141	42.647	0.000
Hard Drive per GB	0.450	0.014	32.279	0.000
7200 RPM Hard Drive	37.552	4.087	9.187	0.000
Blu-Ray Reader	383.201	2.836	135.104	0.000
512 MB Video Card	69.000	5.568	12.392	0.000
1 GB Video Card	120.000	8.117	14.784	0.000
Integrated Web Cam	30.000	3.215	9.332	0.000
Mobile Broadband	117.797	3.631	32.441	0.000
9 Cell Battery	69.000	3.937	17.525	0.000
Bluetooth	20.848	2.836	7.350	0.000
Windows 7 Professional	83.000	4.051	20.486	0.000
Office Home Student	108.014	7.164	15.077	0.000
Office Home Business	177.614	4.839	36.702	0.000
Office Professional	309.429	3.157	98.017	0.000
Company A	-98.187	14.448	-6.796	0.000
Company C	667.136	6.394	104.345	0.000

Observations = 3,360; Adj R Square = 0.978; Stnd Error of Estimate = 81.835; F = 8,732.32
Base configuration (relative to dummy/qualitative characteristics) were: 5,400 RPM Hard Drive; No Optical Drive/DVD-RW; Integrated Video; 6 Cell Battery; Windows 7 Home Premium; No Productivity Software; Company D.

79. Another BLS document[43] explains why hedonic quality adjustment is not used anymore to form the Producer Price Index for computers, a comment that I

[43] "How BLS Measures Price Change for Personal Computers and Peripheral Equipment in the Consumer Price Index," Bureau of Labor Statistics, https://www.bls.gov/cpi/cpifaccomp.htm.

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have put in bold because it reveals the unusual speed of changes in product design in this industry and the consequent need for sellers to compete via product quality as well as price. The focal point price remains operational only as long as the same product is sold for the same price. Per the quote below from the BLS the shelf-lives of the same products are too brief for the use of hedonic methods of quality adjustment. In the next section, I will discuss the shelf-life of products at Best Buy. Most do not last a year and hardly any last two years.

> From January 1998 to September 2003 the CPI program used hedonic regressions, developed in a cooperative effort with the Producer Price Indexes (PPI) and International Price Program (IPP) programs, as a basis to determine appropriate quality adjustments amounts for personal computers. While this endeavor was viewed as successful and worthwhile, the CPI program decided to adopt a different approach. It should be noted that the hedonic quality adjustments regarding chip speed were deemed unreliable and were never applied to CPI data.
>
> **Because the individual components in PC configurations change so rapidly,** the CPI program began to move towards an approach that uses attribute values available on the Internet as a basis to determine appropriate quality adjustments amounts. By 2003, a process of attribute cost adjustment was fully implemented. The attribute cost adjustment database for desktops computers has seven attribute categories. Each attribute category is populated with the values of specific components, resulting in a database of 250 to 300 attribute values which are updated monthly.

D. Pass-through with Focal Points and Rapid Declines in Quality-Adjusted Prices

80. Designers of new products that sell at a focal point need to take into consideration all the costs of manufacturing and distribution, leaving room for profits along the supply chain including manufacturing, distribution and retail.

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The existence of retail price points does not prevent elevated battery prices from being passed on to the introductory prices of products.

81. The initial design must consider the costs at the introductory point in time and also cost changes that might occur during the shelf-life of the product. If the introductory price is expected to be held for a period over which there will be significant changes in costs, that include these batteries, the product design must consider all the costs.

82. Best Buy provided shelf-life data for individual models in addition to the sales and cost data. I use this data to compute the shelf life of notebook and camcorder product models. I use the product introduction date and off-the-shelf date provided in the data to compute the number of months each individual product was offered. I summarize the distributions separately for notebooks and camcorders in Figure 15 and Figure 16, respectively. The vast majority of models of both notebooks and camcorders are replaced within the first year after introduction. Over 95 percent of models are replaced within 24 months. This suggests that components' value depreciates quickly due to the rapid technological innovation and products are rapidly replaced with more advanced models. As a result, two models offered at the same price in close temporal proximity to one another would likely have significant characteristic and quality differences.

83. I also compute the median notebook and camcorder model shelf life year by year. In any given year, I identify the products that were removed from sale in that year. The difference between the date of removal and the date of introduction is the age at product termination. Figure 17 and Figure 18 below illustrate the median and mean of these terminal ages in each year for notebooks and camcorders. The median shelf life of a notebook product model was four months or less in each year, 2000 to 2009, and six months or less in both 2010 and 2011. For camcorders, the median shelf life was 13 months or less in each year.

Figure 15

[redacted]

Figure 16

[redacted]

Figure 17

[redacted]

Figure 18

[redacted]

84. Using the same data, I compute the shelf lives of focal point prices. I define the shelf-life of a focal point as the number of months since first sale and the earlier of last sale or first sale at a reduced price. [redacted]

Figure 19

[redacted]

85. In conclusion, the defendants' focal price hypothesis falls apart when actual evidence is explored. Actual prices are not nearly so concentrated on "focal points" as the defendants' rhetoric would suggest. Actual focal points do not last very long. Either prices are cut, or the products are entirely removed from the shelves.

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E. Constant Price and Constant Cost but Increasing Quality

86. I have explained previously that although finished products may be sold at prices that are not completely flexible through time, that does not mean that declines in costs of the components (*e.g.* batteries) are not passed on to consumers. These declines in the costs may be passed on to consumers in the form of improved quality of the products sold at the same price.

87. This can be illustrated using HP monthly sales data for laptops from February 2003 to October 2008, nearly a six-year interval of time. I have restricted attention to the laptops that were sold for prices between $900 and $1000. The HP sales prices are illustrated in the Figure 20 below with each dot representing the sale of notebooks at that price on that date. By selection, these are all between $900 and $1000. The corresponding HP costs, illustrated also in Figure 20, were relatively stable as well. Thus, the caption: Constant Price and Constant Costs.

88. The set of pictures in Figure 21 illustrate how the features of these laptops changed over time. The first figure illustrates the size of the hard-drives of these HP notebooks. In 2003, the hard drives had between 20 GB and 30 GB of space, but five years later in 2008 the range was between 100 GB and 320 GB. There are similar notable improvements over time in most of the other features: larger monitors, more RAM, larger cache, improved architecture (32 vs. 64 bit), greater number of cores, and more threads. The battery capacity also improves but not in such an evident way.[44]

89. How could the laptops sold late in this period, with substantially better features, cost about the same as they did five years earlier and sell for about the same price? The only possible answer is that the costs of these features including the battery were declining, thus allowing the design of laptops with better features but costing about the same, allowing the improved laptop to sell for about the same price. That's the pass-through mechanism at work. Quality improvements substitute for reductions in price points.

[44] See APPENDIX B for a description of these technical features.

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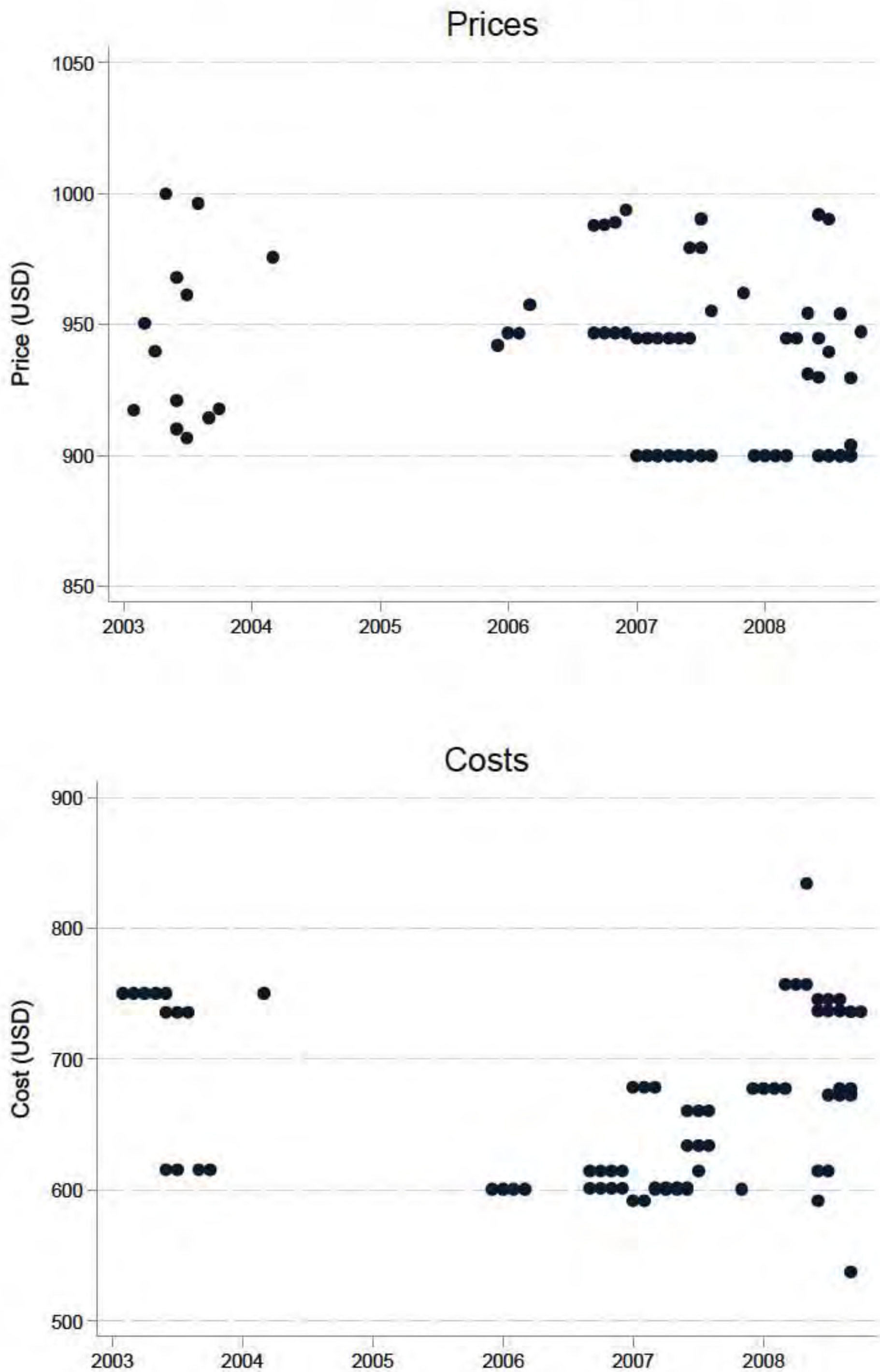
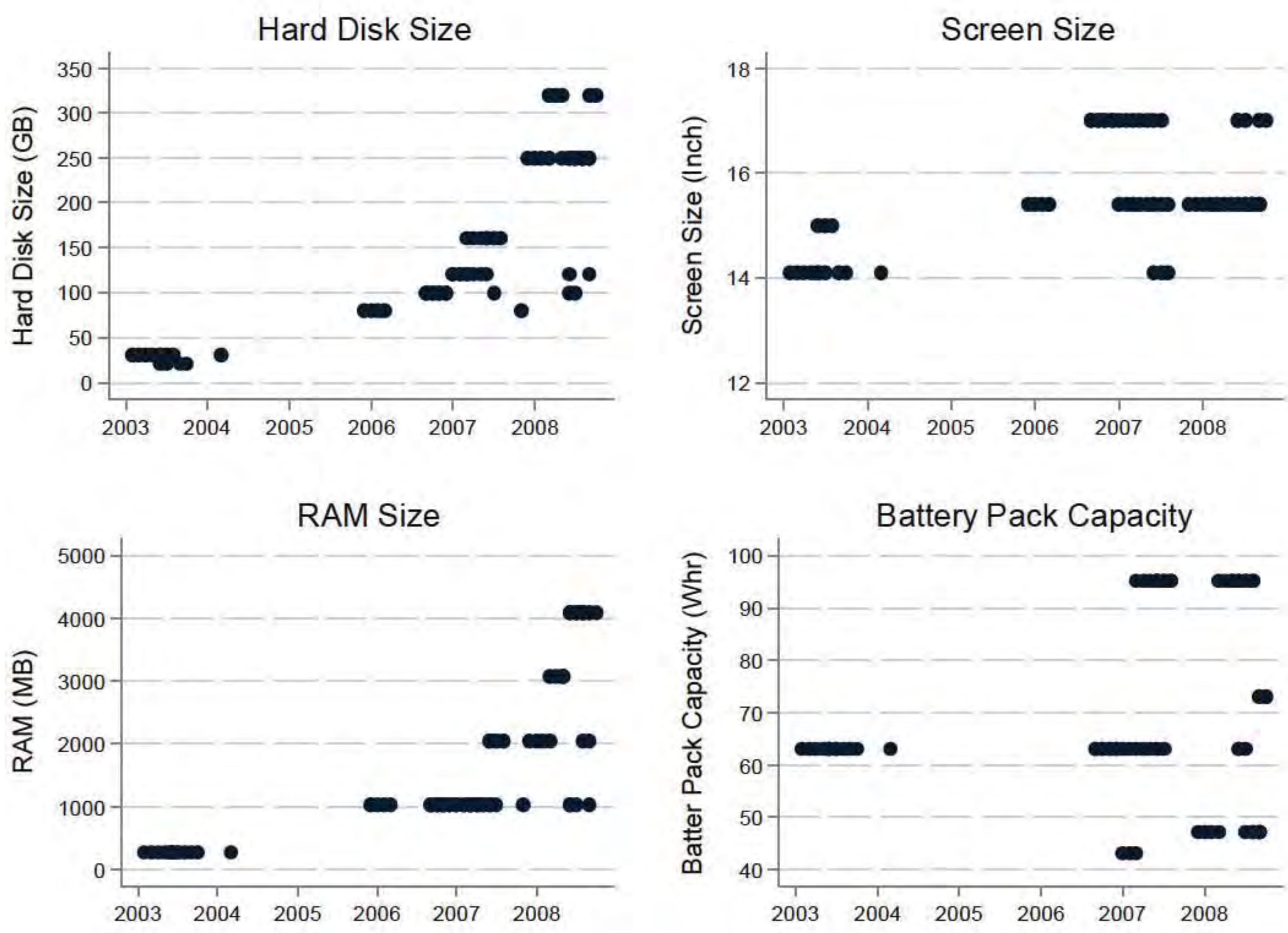
90. The same kind of displays using Acer data are provided below the HP displays. Figure 22 has the prices of Acer notebooks sold between 2003 and 2010 at prices in the interval between $900 and $1,000, and below that are the corresponding costs which vary in the range from about $700 to $1,100. In other words, more or less constant prices and constant costs. Figure 23 has the features of these laptops. As was the case with HP laptops most of the features of these Acer laptops improved noticeably over this eight-year interval of time. The hard drive grew from 40 GB in late 2004 to 500 GB in 2010. RAM increased from 512 MB and below through 2005 to 4096 MB (4 GB) in 2010. There are similar notable improvements over time in most of the other features: larger monitors, more RAM, larger cache, improved architecture (32 vs. 64 bit), greater number of cores, and more threads. Screen size doesn't show much change in an evident way.

Figure 20: HP Constant Price and Constant Costs



Note: Only Laptops Priced between $900 and $1000 are displayed

Figure 21: HP Improving Laptop Features



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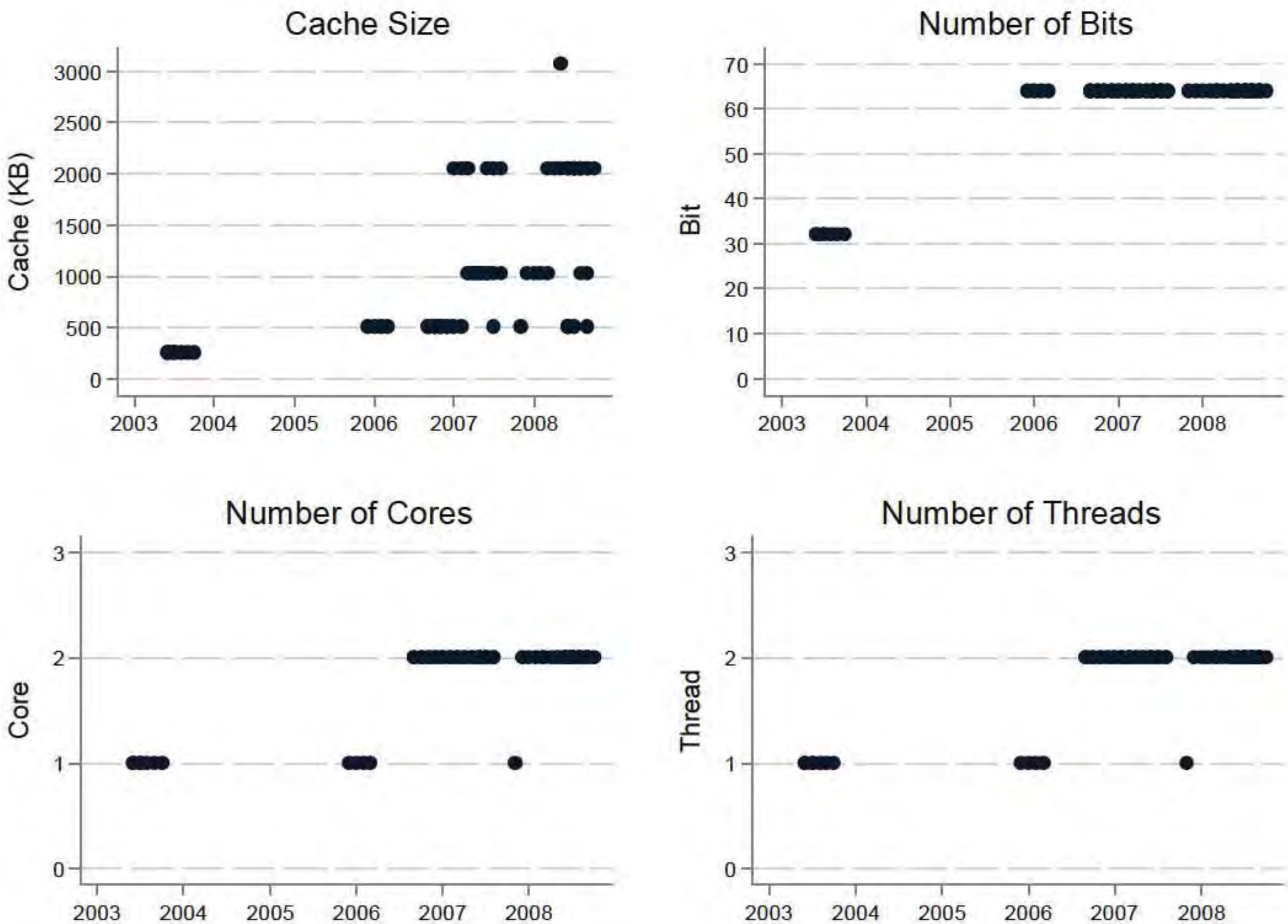
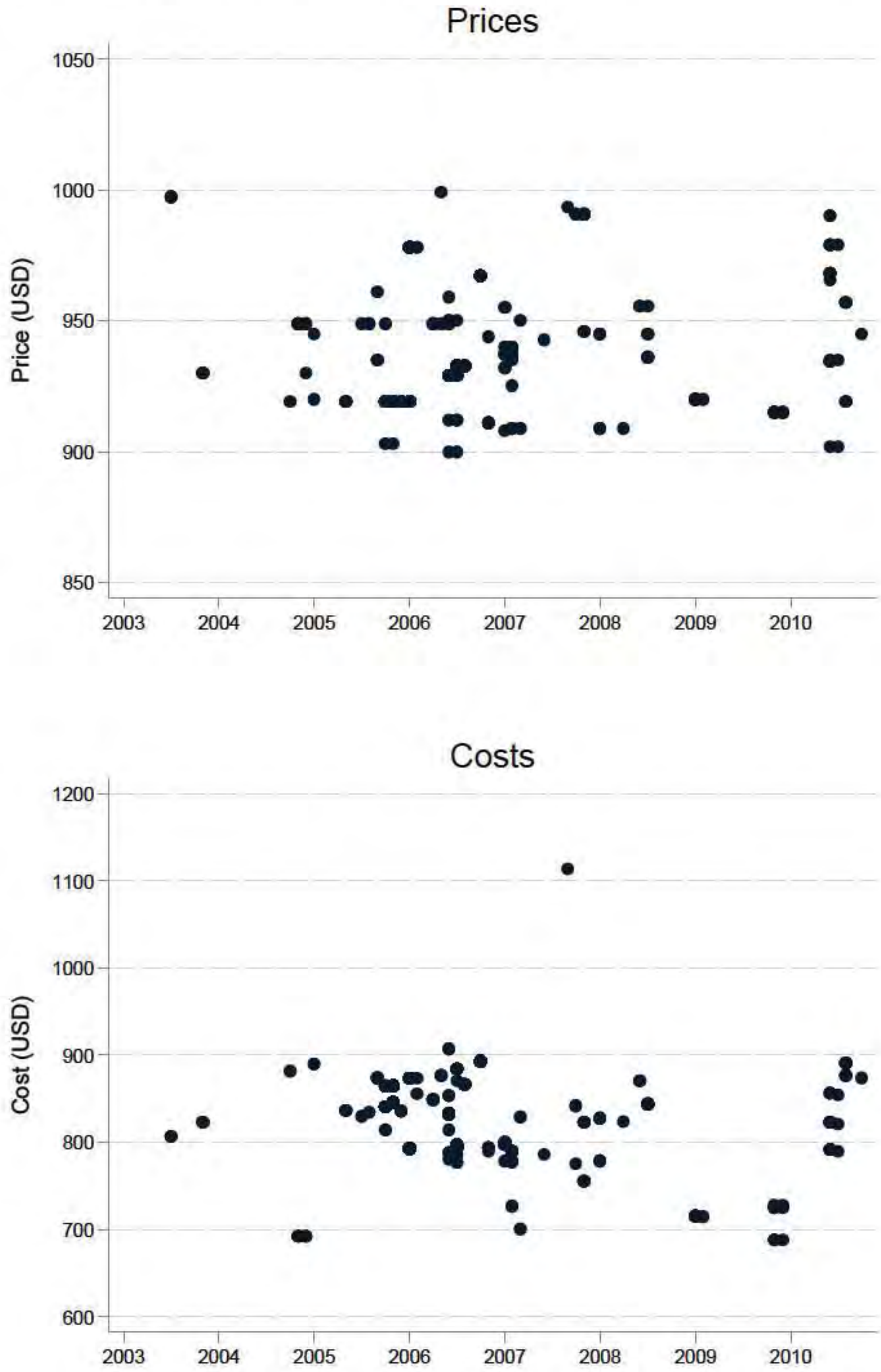
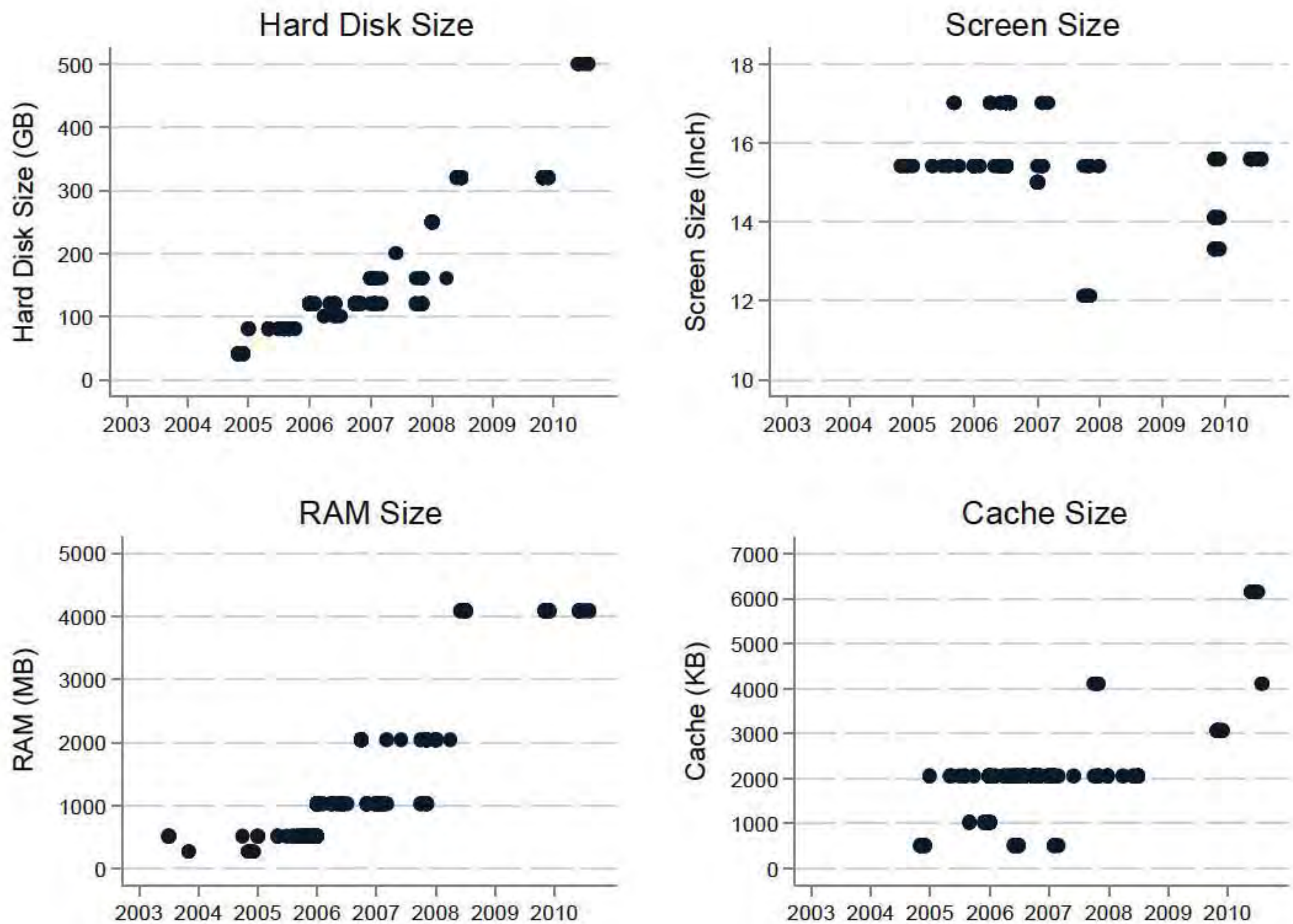


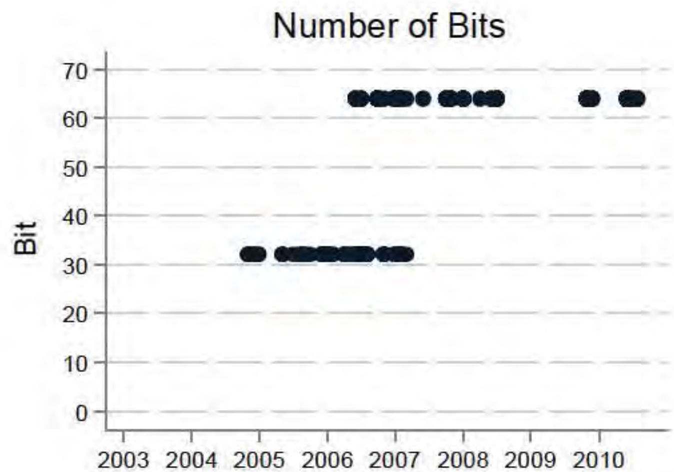
Figure 22: Acer Constant Price and Constant Costs

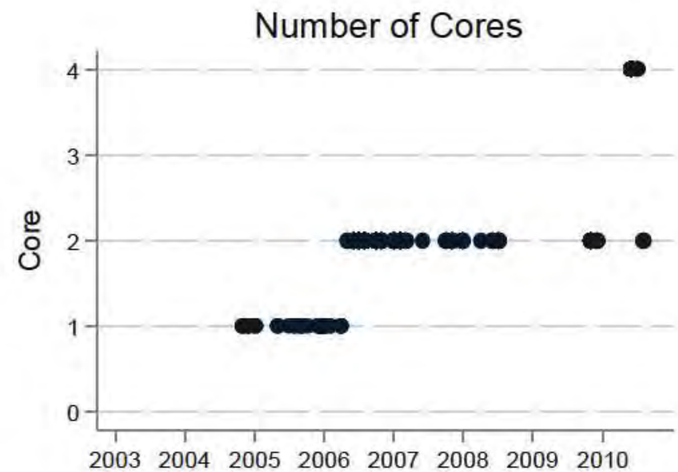


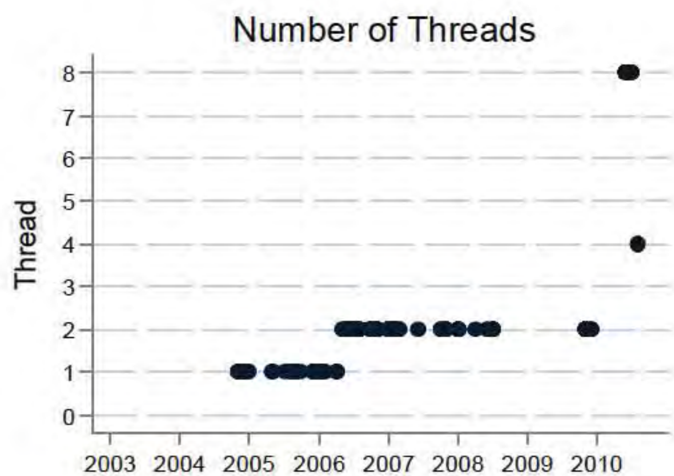
Note: Only Laptops Priced between $900 and $1000 are displayed

Figure 23: Acer Improving Laptop Features




Number of Bits
Bit
0
10
20
30
40
50
60
70
2003
2004
2005
2006
2007
2008
2009
2010


Number of Cores
Core
0
1
2
3
4
2003
2004
2005
2006
2007
2008
2009
2010


Number of Threads
Thread
0
1
2
3
4
5
6
7
8
2003
2004
2005
2006
2007
2008
2009
2010

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91. The tools at the manufacturers' disposal for making quality adjustments that pass-through elevated component costs to consumers can be illustrated by the regressions below using data on HP and Acer laptop costs, sales, and characteristics.

92. Figure 24 (HP) and Figure 25 (Acer) are regressions with total cost of a laptop as the dependent variable explained by laptop characteristics, including monitor size, battery capacity, cache, and processor speed. A regression of laptop total cost on its characteristics provides an estimate of those component costs. It is similar to the "hedonic regression" formerly used by BLS and described above, but with costs as the dependent variable, instead of price.

93. For each manufacturer, separate regressions are performed for two periods. The regressions generally have a high R-square showing that over 90 percent of the variation in costs are explained by the laptop features. With the limited data available and increasing quality of components, the estimates may not be used to provide an accurate description of the components costs—some estimates will have results that are intuitive (*e.g.*, positive marginal cost of monitor size) and some will not (*e.g.*, negative marginal cost of battery).

94. However, these regressions illustrate the quality-adjustment tools available to manufacturers to pass on cost impacts. Given that total cost is almost entirely determined at the design phase by the components, if the manufacturer wishes to maintain a fixed total cost of the product, it can do so by altering the components of the product. For example, had HP faced lower LIB costs absent the conspiracy, it could have placed a better quality battery in the laptop or another component of better quality (*e.g.*, HDD or ODD). In addition, the regressions for the two different periods illustrate the increase in quality and decrease in marginal cost of these components. For example, the marginal cost of an additional inch added to the monitor decreased from the first period to the second period.

95. Further, I perform hedonic regressions of the price of a product on its characteristics separately for two different periods. Such regressions can show how different components contribute to the ability of a manufacturer to charge a price to its customers. These regressions generally show a high R-square with

over 88 percent of price explained by the components of the laptop. As with the cost regressions, the data has limited ability to precisely identify the implicit prices of each component. However, just as with the cost regression described above, these regressions illustrate some of the quality-adjustments available to manufacturers to pass-on LIB overcharges. Specifically, if a manufacturer wanted to hold the price of a product to a specific price point, it can do so by altering the characteristics of the product. These quality-based impacts on consumers can be through reducing laptop quality or merely by slowing the rate of product improvements. Furthermore, the regressions estimated for two periods show the generally declining value of a characteristic over time.

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Figure 24

Hedonic Analysis of HP Laptop Characteristics

Variable	Cost 2003Q2 - 2007Q1	Cost 2007Q4 - 2008Q4	Price 2003Q2 - 2007Q1	Price 2007Q4 - 2008Q4
(1)	(2)	(3)	(4)	(5)
1. Monitor Size (Inches)	46.97 ***	13.38 ***	72.30 ***	16.60 **
2. Battery Capacity (Whr)	-2.24 ***	0.99 ***	-1.97 ***	2.40 ***
CPU Brand				
3. AMD Base (Base)				
4. Intel	54.43	56.37 ***	-5.60	-116.46 ***
Cache size				
5. 256 KB	266.85 **		73.81	
6. 512 KB	33.67 ***	-18.14	7.30	2.93
7. 1024 KB (Base)				
8. 2048 KB	81.03 *	23.48 **	81.26	117.21 ***
9. 3072 KB		147.94 ***		353.59 ***
10. 4096 KB	123.57	469.84	138.45	940.44
System bits				
11. 32 bits (Base)				
12. 64 bits	-54.06		-213.98 ***	
CPU Threads				
13. 1 thread (Base)				
14. 2 threads	172.34 ***		307.74 ***	
15. HDD size (GB)	2.20 ***	0.44 ***	1.52 ***	1.05 ***
ODD Type				
16. Bluray		-115.69 ***		-208.64 ***
17. COMBO	42.37		32.27	
18. DVD-HD		-68.21 **		-164.80 ***
19. DVD-Rom (Base)				
20. DVD-RW	-10.17	-165.15 ***	-242.91	-291.77 ***
Windows OS				
21. Vista (Base)				
22. XP	28.99 ***	27.33	70.57 ***	153.88
23. Processor Speed (Ghz)	436.55 ***	-29.07	582.32 ***	-137.88
Ram				
24. 256 MB	-164.61 ***		-542.61 ***	
25. 512 MB	-166.12 ***		-526.58 ***	
26. 1024 MB	-103.71 ***	41.87	-248.87 ***	99.37
27. 2048 MB (Base)				
28. 3072 MB		15.22		-12.40
29. 4096 MB		44.88 ***		8.62
30. Constant	-1041.19 ***	441.24 ***	-903.02 ***	708.63 ***
Adjusted R^2	0.99	0.92	0.98	0.884
Observations	91	144	91	147

Note: *** Statistically significant at 1% level, ** 5% level, 10% level.

Figure 25

Hedonic Analysis of Acer Laptop Characteristics

Variable	Cost 2002Q4 - 2009Q1	Cost 2009Q4 - 2010Q4	Price 2002Q4 - 2009Q1	Price 2009Q4 - 2010Q4
(1)	(2)	(3)	(4)	(5)
1. Monitor Size (Inches)	26.95 ***	16.82 ***	8.25	1.36
CPU Brand				
2. AMD Base (Base)				
3. Intel	-15.87	59.51 ***	9.76	123.37 ***
Cache size				
4. 256 KB	-26.46		24.25	
5. 512 KB	22.57	77.83 ***	57.70	193.24 ***
6. 1024 KB (Base)				
7. 2048 KB	81.46 ***	57.80 ***	111.15 ***	111.97 ***
8. 3072 KB		137.77 ***		195.10 ***
9. 4096 KB	638.70 ***	424.61 ***	1066.28 ***	409.22 ***
System bits				
10. 32 bits (Base Period 1)				
11. 64 bits (Base Period 2)	-23.65 *		15.51	
CPU Threads				
12. 1 thread (Base)				
13. 2 threads	78.94 ***	67.60 ***	90.07 ***	73.24 ***
14. 3 threads		117.22 ***		241.48 ***
15. 4 threads		-0.21		-26.38 **
14. HDD size (GB)	1.05 ***	0.37 ***	1.15 ***	0.52 ***
ODD Type				
15. Bluray		-2.35		-5.81
16. CD-Rom	851.18 ***		1401.80 ***	
17. CD-R/CD-RW/DVD-R	-15.46		-32.99 *	
18. DVD-Rom (Base)				
19. DVD-RW	-7.23	-27.30 ***	6.27	-23.99 ***
Windows OS				
20. Vista (Base Period 1)				
21. Windows 7 (Base Period 2)				
22. XP	206.33 ***		282.35 ***	
23. Processor Speed (Ghz)	-61.61 ***	-10.36	-121.71 ***	58.36 ***
Ram				
24. 256 MB	18.89		0.68	
25. 512 MB	45.23 **		33.25	
26. 1024 MB	5.45		11.90	
27. 2048 MB (Base)				
28. 3072 MB	-136.76 ***	18.85 **	-147.30 ***	1.69
29. 4096 MB	-337.72 ***	-29.13 ***	-274.18 **	-34.07 ***
30. Constant	40.98		394.36 ***	
Adjusted R^2	0.551	0.970	0.565	0.952
Observations	752	489	752	489

Note: *** Statistically significant at 1% level, ** 5% level, 10% level.

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V. Additional Pass-Through Regressions

96. In my previous reports, I analyzed data from OEMs, distributors, and retailers that included sales to other businesses, government entities,[45] and consumers. The estimates of pass-through that resulted were mostly close to or above 100 percent. As I noted in my original report, pass-through rates of over 100 percent are compatible with economic theory. They may result, for example, from strategies utilized by firms in imperfectly competitive industries, where market power may allow firms to raise prices above the increase in costs (*i.e.*, overshifting).[46] After my Reply Report, I received data and information from additional third-party entities. I have updated my pass-through analyses using data from seven additional third-party entities. The additional pass-through estimates, like the earlier ones, are mostly close to or above 100 percent.

97. Figure 26 summarizes, by distribution level and product types, the volume of commerce contained in the pass-through analysis data. In sum, I estimated 110 regressions using data covering over 430,000 product model codes and $153 billion in sales.[47] A more detailed summary table of sales, year coverage, and value of sales for each third-party entity used in the regressions is included in Appendix A. The entities included in my pass-through analysis account for a substantial proportion of sales at each level of the distribution chain.[48]

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[45] For example, the Dell sales data I analyzed included government entities.

[46] Leamer Report, at 65-66.

[47] My regressions cover 52 distinct company and product type combinations and three packers. This number compares very favorably with studies in the empirical literature. For instance, Besley and Rosen (1999) study sales tax incidence using data for 12 commodities and Campa and Goldberg (2005) study exchange rate pass-through into the import prices of 23 OECD countries. See Timothy J. Besley and Harvey S. Rosen, "Sales Taxes and Prices: An Empirical Analysis," National Tax Journal 52-2 (June 1999); Jose Manuel Campa and Linda S. Goldberg, "Exchange Rate Pass-Through into Import Prices," Review of Economics and Statistics 87- 4 (November 2005).

[48] For instance, my pass-through work includes two of the three major non-defendant packers. Simplo, Dynapack and Celxpert are the largest independent packers, of which my analysis includes Simplo and Dynapack. *See* SONY-LIB-000818909-000818918 at 910. At the OEM level also, my analysis includes the major product manufacturers. Among notebook manufacturers, for instance, I utilize data provided by Dell, HP, Toshiba, Acer, Fujitsu, and Sony, which accounted for roughly 65 percent of global notebook sales from 2005Q2-2006Q2. *See* LGC-MDL-0340830 at "IDC data." At the retailer level, my analysis covers the biggest retailers including BestBuy, Wal-Mart, Target, Costco and Amazon. In particular, it includes four of the top

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98. Figure 27 summarizes the estimated pass-through rates from these 110 regressions, which are reported individually in Figure 29 and Figure 30. The pass-through estimates are sorted into five different categories depending on where the corresponding confidence interval lies in relation to the two relevant hypotheses: 100 percent pass-through and zero percent pass-through.

99. The first category refers to pass-through estimates which are above 100 percent with 95 percent confidence bands short enough not to include 100 percent. These are statistically reliable pass-through estimates in excess of 100 percent. This is the largest category.

100. The second category has 95 percent confidence intervals that include 100 percent but exclude zero percent, thus statistically compatible with 100 percent pass-through but incompatible with zero percent. This is the second largest category.

101. The third group of estimates has pass-through rates between zero percent and 100 percent with confidence intervals including neither 100 percent, nor zero percent. These are cases in which there is support for "moderate" pass-through between zero percent and 100 percent. This is the third largest group.

102. Category four refers to confidence intervals that include zero percent but exclude 100 percent. These could be called "small" pass-through estimates. There are only two such cases. Last are the very unreliable estimates that are statistically indistinguishable from both zero percent and 100 percent. There are a few of these.

103. Overall, the estimates lean in favor of pass-through rates in excess of 100 percent.[49] Furthermore, the estimates which are statistically indistinguishable

five U.S. consumer electronics' retailers of 2009. *See* Alan Wolf, "Top 100 Rankings," *TWICE Special Report*, June 17, 2010, 24.

[49] One of the highest pass-through estimates with fixed effects is equal to 341 percent and applies to Target camcorders, but the result alerts us not to place too much stock in this figure, *e.g.*, the confidence interval for the estimate extends from 18 percent to 663 percent. The Target camcorder data includes only 35 observations on changes in costs of camcorders, of which 33 cost changes are zero. The two non-zero cost changes apply to the same camcorder product leaving the other two camcorder products without any variability in costs. This is an unsatisfactory data set for estimating a precise pass-through rate. There are

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from zero percent pass-through are associated with very small value of sales relative to the overall sales analyzed (less than 0.001 percent). Consequently, there is virtually no doubt that there is positive pass-through throughout the various levels of the distribution chain.

104. The magnitudes of these pass-through estimates support a pass-through rate of 100 percent or more. Hence, my conclusion from the initial report remains unchanged that "[t]he empirical results are entirely consistent with expectation from economic theory that the best estimate of pass-through to consumers is 100 percent and provide no support for a lower pass-through rate."[50] However, we can also calculate the average pass-through rate suggested by the available data. In Figure 28, I report sales-weighted average pass-through rates from the regressions.

other extreme results among the 110 regressions I estimated. The lesson is to look to the overall message from the data about pass-through rates and not fixate on individual results that may result in issues with specific data sets.

[50] Leamer Report, 71.

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Figure 26

Summary of Commerce Covered in Pass-Through Data

Level	Product	Number of Companies	Number of Observations		Sales	Number of Models
(1)	(3)	(5)	(5)		(6)	(7)
					(million USD)	
Packer	Notebook	3	1,121	$	581.78	29
OEM	Notebook	8	524,922		56,389.83	324,725
OEM	Camcorder	3	15,644		15,762.25	980
OEM	Power Tool	3	3,373		363.19	138
Distributor	Notebook	3	74,111		6,989.02	14,832
Distributor	Camcorder	2	4,923		60.82	581
Distributor	Power Tool	1	50		0.03	9
Retailer	Notebook	16	311,895		63,755.48	86,148
Retailer	Camcorder	11	58,169		9,638.75	4,420
Retailer	Power Tool	5	13,641		32.18	856
Total				**$**	**153,573**	**432,718**

Note: (1) 1st and 99th percentile of prices and costs for each product-year removed as outliers.
(2) Transactions removed if notebook price<$100; camcorder price<$20; power tools<$10.
(3) Number of observations is the total number of monthly records for all model codes (annual in case of Best Buy).

Figure 27: Regression Results Show 100 Percent Pass-Through

Pass-Through Confidence Interval Summary
Packers, OEMs, Distributors, and Retailers
Finished Products and Non-Defendant Battery Packs

		No Fixed Effects		Fixed Effects		**Combined**
	Pass-Through Rate	Number of Regressions	Sales	Number of Regressions	Sales	**Number of Regression**
		(1)	(2)	(3)	(4)	(5)
			(million USD)		(million USD)	
1	Statistically greater than 100%	28	99,171 36	18	48,575 47	**46**
2	Statistically indistinguishable from 100%	13	9,131 16	20	35,710 96	**33**
3	Statistically greater than 0% and less then 100%	12	23,217 94	14	46,198 07	**26**
4	Statistically less then 100% and indistinguishable from 0%			2	1,054 49	**2**
5	Statistically indistinguishable from 0% and 100%	2	18 72	1	0 19	**3**
6	**Sales-Weighted Share of Pass-Through Greater Than 0%**	**99.999 %**		**99.906 %**		
	Total	**55**	**131,539**	**55**	**131,539**	**110**

Notes: The statistical comparison to 0% and 100% was performed using the following rules:
Statistically greater than 100% - 100% < Lower bound < Upper bound
Statistically indistinguishable from 100% - 0% < Lower bound < 100% < Upper bound
Statistically greater than 0% and less then 100% - 0% < Lower bound < Upper bound < 100%
Statistically less then 100% and indistinguishable from 0% - Lower bound < 0% < Upper bound < 100%
Statistically indistinguishable from 0% and 100% - Lower bound < 0% < 100% < Upper bound

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Figure 28

LIB Finished Product End-User Pass-Through

Level	Notebook	Camcorder	Power Tools	Sales-Weighted Average
(1)	(2)	(3)	(4)	(5)
	No Part Number Fixed Effects			
1. Packer	127%			
2. OEM	112%	125%	103%	
3. Distributor	102%	103%	111%	
4. Retailer	114%	103%	102%	
5. **End-user pass-through** *[Row(1)*Row(2)*Row(3)*Row(4)]*	165%	132%	118%	**160%**
	Part Number Fixed Effects			
7. Packer	95%			
8. OEM	92%	71%	143%	
9. Distributor	101%	100%	48%	
10. Retailer	144%	260%	57%	
11. **End-user pass-through** *[Row(7)*Row(8)*Row(9)*Row(10)]*	128%	184%	39%	**136%**

Note: (1) Rows (1)-(4) represent sales-weighted average pass-through rate estimates from regressions.
(2) End-user pass-through computed by multiplying the pass-through rates of each level. Where not available, 100% pass-through rate is applied.

Figure 29

LIB Finished Product Pass-Through Estimates Summary
No Part Number Fixed Effects

		Notebook		Camcorder		Power Tools	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Packer	[redacted] Dyn to Acer	132 %	(118%,145%)				
Packer	Dynapack to Dell	82 %	(73%,92%)				
Packer	[redacted] to Dell	223 %	(170%,277%)				
OEM	AOpen	61 %	(-1%,124%)				
OEM	Acer	124 %	(122%,126%)				
OEM	Black and Decker					103 %	(91%,114%)
OEM	Bosch					159 %	(153%,165%)
OEM	[redacted]			185 %	(181%,189%)		
OEM	Cornwell					108 %	(104%,111%)
OEM	Dell	130 %	(126%,133%)				
OEM	Fujitsu	138 %	(133%,143%)				
OEM	Gateway	123 %	(106%,139%)				
OEM	HP	109 %	(79%,140%)				
OEM	JVC			140 %	(136%,144%)		
OEM	Sony	104 %	(102%,105%)	118 %	(115%,121%)		
OEM	Toshiba	107 %	(106%,108%)				
Distributor	ASI	89 %	(80%,98%)				
Distributor	Ingram	102 %	(102%,102%)	103 %	(103%,103%)		
Distributor	Petra Industries			90 %	(55%,125%)	111 %	(106%,116%)
Distributor	SED	94 %	(92%,96%)				
Retailer	ACE Hardware					105 %	(99%,111%)
Retailer	Amazon	171 %	(66%,276%)				
Retailer	B&H			109 %	(107%,112%)		
Retailer	Best Buy	132 %	(132%,133%)	148 %	(147%,149%)		
Retailer	Brandsmart	101 %	(100%,103%)	106 %	(93%,118%)		
Retailer	CDW	81 %	(79%,84%)				
Retailer	Circuit City	100 %	(98%,103%)	49 %	(31%,66%)		
Retailer	CompUSA	98 %	(95%,100%)				
Retailer	CompuCom	88 %	(86%,90%)				
Retailer	Costco	102 %	(101%,104%)				
Retailer	Crutchfield			117 %	(112%,122%)		
Retailer	Fry's					58 %	(43%,73%)
Retailer	Home Depot					109 %	(106%,111%)
Retailer	Insight	90 %	(87%,92%)				
Retailer	MEI	93 %	(89%,97%)	103 %	(99%,107%)		
Retailer	Nebraska FM	103 %	(95%,111%)				
Retailer	Newegg	77 %	(69%,85%)	102 %	(101%,102%)		
Retailer	PC Connection	91 %	(90%,92%)	111 %	(110%,111%)		
Retailer	[redacted]	97 %	(96%,97%)	105 %	(105%,106%)		
Retailer	Target			78 %	(-37%,194%)	140 %	(59%,222%)
Retailer	[redacted]	98 %	(85%,111%)	153 %	(121%,184%)	115 %	(111%,119%)
Retailer	Zones	111 %	(108%,115%)				

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1).
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Long-Run Pass-Through estimates are presented.
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.
(8) Walmart analysis uses unweighted averages due to absence of quantity sold.

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Figure 30

LIB Finished Product Pass-Through Estimates Summary
Part Number Fixed Effects

		Notebook		Camcorder		Power Tools	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Packer	[redacted] Dyn to Acer	90 %	(81%,100%)				
Packer	Dynapack to Dell	87 %	(80%,94%)				
Packer	[redacted] to Dell	126 %	(104%,147%)				
OEM	AOpen	161 %	(111%,212%)				
OEM	Acer	125 %	(118%,133%)				
OEM	Black and Decker					145 %	(90%,200%)
OEM	Bosch					188 %	(131%,244%)
OEM	[redacted]			117 %	(98%,135%)		
OEM	Cornwell					92 %	(78%,105%)
OEM	Dell	134 %	(125%,142%)				
OEM	Fujitsu	110 %	(103%,117%)				
OEM	Gateway	15 %	(-12%,42%)				
OEM	HP	174 %	(49%,298%)				
OEM	JVC			94 %	(86%,102%)		
OEM	Sony	83 %	(71%,94%)	62 %	(54%,71%)		
OEM	Toshiba	82 %	(80%,84%)				
Distributor	ASI	70 %	(53%,87%)				
Distributor	Ingram	102 %	(101%,102%)	100 %	(99%,101%)		
Distributor	Petra Industries			(1)%	(-124%,121%)	48 %	(-1%,97%)
Distributor	SED	101 %	(98%,105%)				
Retailer	ACE Hardware					42 %	(36%,48%)
Retailer	Amazon	75 %	(34%,116%)				
Retailer	B&H			82 %	(75%,90%)		
Retailer	Best Buy	99 %	(94%,104%)	181 %	(173%,190%)		
Retailer	Brandsmart	96 %	(90%,103%)	169 %	(134%,204%)		
Retailer	CDW	75 %	(73%,78%)				
Retailer	Circuit City	176 %	(168%,183%)	362 %	(315%,410%)		
Retailer	CompUSA	304 %	(290%,318%)				
Retailer	CompuCom	80 %	(78%,82%)				
Retailer	Costco	120 %	(112%,129%)				
Retailer	Crutchfield			302 %	(251%,352%)		
Retailer	Fry's					138 %	(100%,175%)
Retailer	Home Depot					42 %	(30%,55%)
Retailer	Insight	43 %	(41%,46%)				
Retailer	MEI	115 %	(112%,119%)	125 %	(116%,134%)		
Retailer	Nebraska FM	114 %	(59%,169%)				
Retailer	Newegg	95 %	(90%,101%)	91 %	(80%,102%)		
Retailer	PC Connection	96 %	(96%,97%)	117 %	(113%,121%)		
Retailer	[redacted]	71 %	(70%,73%)	106 %	(98%,113%)		
Retailer	Target			341 %	(18%,663%)	140 %	(57%,224%)
Retailer	[redacted]	28 %	(18%,38%)	52 %	(49%,56%)	136 %	(109%,162%)
Retailer	Zones	93 %	(73%,112%)				

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1), Part Number Fixed Effects.
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Long-Run Pass-Through estimates are presented.
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.
(8) Walmart analysis uses unweighted averages due to absence of quantity sold.

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VI. Damages Adjusted for Class Members' States of Residence and Pass-Through Rates

105. I have been asked to demonstrate a method to compute damages for the thirty states for which class certification is being sought. Figure 31 apportions the damages estimates I provided in my initial report[51] for the populations that resides in these thirty states. I use the average ratio of population in these thirty states to U.S. population over the class period to make this adjustment.

106. As before, I use 100 percent pass-through rate to the class-members in calculation of these damages. I could easily calculate damages using the pass-through rates shown in Figure 28. Given the scope of my assignment—to evaluate the availability of reliable evidence common to the class to demonstrate the widespread effect of the conspiracy—the choice of calculation is immaterial at this stage and in any event, may be a legal question.

[51] Leamer Report at Figure 44. Since my original report, I have added NEC cylindrical LIB to the dataset and made a few minor updates to the data which are not reflected in the Figure 31 below.

Figure 31

All Defendant Cylindrical LIB Damages for Class States

	Cells	Cells in Packs	Total
			(1) + (2)
	(1)	(2)	(3)
Global Sales of Class Products During Class Period (Thousand Units)	3,554,599	3,796,597	7,351,195
U.S. Sales During Class Period (Thousand Units)	1,066,380	1,138,979	
Class States' Sales During Class Period (Thousand Units)	631,844	674,861	1,306,705
Overcharge During Class Period (%)	18.6 %	13.9 %	
Overcharge During Class Period (USD/Cell)	$ 0.36	$ 0.51	
Damages Based on a 100% pass-through (USD Thousand)	$ 226,070.68	$ 346,910.62	$ **572,981.30**

Note: Class product sales are based on market data on cylindrical sales by application.
U.S. share of global sales based on U.S. regional share of global notebook sales.
NEC's sales calculated from market share data.
Class states' share based on ratio of class states population to U.S. population during class period.
Class States are: Alabama, Arizona, Arkansas, California, District of Columbia, Florida, Hawaii, Illinois, Iowa, Kansas, Maine, Massachusetts, Michigan, Minnesota, Mississippi, Missouri, Nebraska, Nevada, New Hampshire, New Mexico, New York, North Carolina, North Dakota, Oregon, South Dakota, Tennessee, Utah, Vermont, West Virginia, and Wisconsin.

Source: Defendants Transactional Sales Data, Overcharge Regression Results, PANA-C000076205, SONY-LIB-000893992, United Sates Census Bureau Display Search Data (DS_2011Q2_Econ One Custom Project_Revised.xls).

Edward E. Leamer, Ph.D.
September 26, 2017

APPENDIX A. Summary of Data Used in Pass-Through Analysis

Pass-Through Analysis Data Summary

Level (1)	Company (2)	Product (3)	Year Coverage (4)	Number of Observations (5)	Sales (6) (million USD)	Number of Models (7)
Packer	[redacted] Dyn to Acer	Notebook	2008-2011	245	$ 226	11
Packer	Dynapack to Dell	Notebook	2006-2011	454	251	8
Packer	[redacted] to Dell	Notebook	2007-2011	422	105	10
OEM	AOpen	Notebook	2002-2010	473	23	85
OEM	Acer	Notebook	1997-2010	6,121	9,145	482
OEM	Black and Decker	Power Tool	2006-2011	1,746	348	93
OEM	Bosch	Power Tool	2010-2010	92	1	12
OEM	[redacted]	Camcorder	2004-2005	314	522	21
OEM	Cornwell	Power Tool	2006-2016	1,535	14	33
OEM	Dell	Notebook	2004-2010	1,573	5,199	75
OEM	Fujitsu	Notebook	2001-2011	56,943	943	33,891
OEM	Gateway	Notebook	1999-2006	515	1,890	177
OEM	HP	Notebook	2003-2009	164	28	51
OEM	JVC	Camcorder	2000-2011	6,388	3,330	517
OEM	Sony	Camcorder	1997-2013	8,942	11,910	442
OEM	Sony	Notebook	2000-2013	221,623	11,314	143,128
OEM	Toshiba	Notebook	1999-2011	237,510	27,848	146,836
Distributor	ASI	Notebook	2001-2011	3,213	106	1,150
Distributor	Ingram	Camcorder	2003-2011	4,843	61	568
Distributor	Ingram	Notebook	2003-2011	66,312	6,577	12,235
Distributor	Petra Industries	Camcorder	2006-2011	80	0	13
Distributor	Petra Industries	Power Tool	2010-2011	50	0	9
Distributor	SED	Notebook	2004-2009	4,586	307	1,447
Retailer	ACE Hardware	Power Tool	2010-2015	1,747	9	61
Retailer	Amazon	Notebook	2007-2008	1,272	61	335
Retailer	B&H	Camcorder	2007-2011	746	110	70
Retailer	Best Buy	Camcorder	2000-2011	1,677	5,142	858
Retailer	Best Buy	Notebook	2000-2011	4,085	30,812	2,857
Retailer	Brandsmart	Camcorder	2001-2006	1,081	15	315
Retailer	Brandsmart	Notebook	2000-2006	4,139	101	1,353
Retailer	CDW	Notebook	2009-2011	21,577	1,333	4,623
Retailer	Circuit City	Camcorder	1997-2009	17,964	4,269	714
Retailer	Circuit City	Notebook	1997-2009	18,905	9,433	1,437
Retailer	CompUSA	Notebook	2001-2007	18,860	11,197	1,612
Retailer	CompuCom	Notebook	1998-2008	22,381	4,062	6,462
Retailer	Costco	Notebook	1998-2008	3,747	1,720	1,675
Retailer	Crutchfield	Camcorder	2000-2011	1,682	18	170
Retailer	Fry's	Power Tool	2000-2011	5,215	4	201
Retailer	Home Depot	Power Tool	2009-2012	4,525	18	552
Retailer	Insight	Notebook	2008-2011	34,366	1,172	11,013
Retailer	MEI	Camcorder	2008-2011	1,306	6	104
Retailer	MEI	Notebook	2008-2011	3,883	382	517
Retailer	Nebraska FM	Notebook	1997-2008	3,661	23	1,202
Retailer	Newegg	Camcorder	2003-2005	1,092	6	150
Retailer	Newegg	Notebook	2002-2005	3,580	120	793
Retailer	PC Connection	Camcorder	2000-2012	6,659	57	887
Retailer	PC Connection	Notebook	2000-2012	73,575	2,076	16,335
Retailer	[redacted]	Camcorder	2007-2015	2,345	5	802
Retailer	[redacted]	Notebook	2007-2015	80,143	1,246	35,458
Retailer	Target	Camcorder	2012-2013	44	1	4
Retailer	Target	Power Tool	2012-2015	39	1	2
Retailer	[redacted]	Camcorder	2009-2016	23,573	9	346
Retailer	[redacted]	Notebook	2009-2016	17,358	10	394
Retailer	[redacted]	Power Tool	2009-2016	2,115	0	40
Retailer	Zones	Notebook	2006-2011	363	5	82
Total				**1,007,849**	**$ 153,573**	**432,718**

Note: (1) 1st and 99th percentile of prices and costs for each product-year removed as outliers.
(2) Transactions removed if notebook price<$100; camcorder price<$20; power tools<$10.
(3) Number of observations is the total number of monthly records for all model codes (annual in case of Best Buy).

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APPENDIX B. Technical Features of Notebook PCs

107. **Hard Drive:** The hard drive functions as the primary computer storage device, that reads (writes) data.[52] The capacity of the hard drive is the amount of storage, measured by the amount of data a user would need to store to fill it up.[53]

108. **Monitor Size:** Measures the distance from one corner to the diagonally opposite corner of the screen's viewable area.[54]

109. **RAM (Random Access Memory):** The main memory in a computer, smart phone or tablet.[55] It is "random access" or volatile memory, which means its contents are lost when the computer is powered off. RAM is made up of small memory chips that combine to form memory modules. When a program is opened by a user it gets loaded from the hard drive into the computer's RAM. Running programs directly from RAM allows computer programs to avoid lag time by not having the pull the information from the hard drive. [56]

110. **Battery Capacity:** Capacity is the total amount of power a battery can produce before being recharged. It is typically measured as the time (hours) for which the battery can sustain a unit of power output (amps or watts). Thus, a cell's capacity may be described as, *e.g.*, 2200 mAh (2200 hours of output of a milliamp).[57] A battery pack's capacity depends on the number of cells, the way they are connected and the individual cells' capacity.[58]

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[54] "Definition of: Monitor Size," PCMAG, https://www.pcmag.com/encyclopedia/term/47215/monitor-size.

[55] "Definition of: RAM," PCMAG, https://www.pcmag.com/encyclopedia/term/50159/ram.

[56] "RAM," Tech Terms, https://techterms.com/definition/ram.

[57] "BU-105: Battery Definitions and what they mean," Battery University, http://batteryuniversity.com/learn/article/battery_definitions.

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111. **Cache:** Similar to RAM, cache is used to store and use recently accessed information. The computer can improve access speeds by pulling information from cache when accessing the same data multiple times.[59] Cache is random access memory, but able to be accessed more quickly than regular RAM. It's typically a lot smaller than RAM since it's more expensive.[60]

112. **BIT Specifications:** A bit is a single digit in the binary number system (0 or 1) and is the smallest element of storage on a computing device.[61] The bit specification is the number of bits that operate as a single unit, so a 32-bit has 32 binary switches working as a unit. A higher bit number helps a computer perform better by allowing it to utilize bigger RAM.[62]

113. **Core:** The number of distinct processors on a single chip that work simultaneously. Addition of more cores allows an increase in processing power through simultaneous processing streams, which allows a process to run in the background without interfering with the primary task.[63]

114. **Threads:** The number of simultaneous instruction steams that execute concurrently on a core, which allows a process to run in the background without interfering with the primary task.[64]

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[63] "Definition of: Dual Core," PCMAG, https://www.pcmag.com/encyclopedia/term/42077/dual-core.

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Exhibit A
List of Additional Materials Relied Upon

Correspondence	Date
Simplo Data Questionnaire Responses	07/14/17

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SDI

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SONY

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Data

Third Party Data

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Exhibit A
List of Additional Materials Relied Upon

Acer

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Exhibit A
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<u>Petra</u>

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List of Additional Materials Relied Upon

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EXHIBIT 6

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IN THE UNITED STATES DISTRICT COURT
FOR THE NORTHERN DISTRICT OF CALIFORNIA
OAKLAND DIVISION

CONFIDENTIAL – TO BE FILED UNDER SEAL
SUBJECT TO PROTECTIVE ORDER

IN RE: LITHIUM ION BATTERIES ANTITRUST LITIGATION THIS DOCUMENT RELATES TO: ALL INDIRECT PURCHASER ACTIONS	No. 13-MD-02420 YGR (DMR)

CORRECTED EXPERT REPORT OF EDWARD E. LEAMER, PH.D.

February 2, 2016

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I. Introduction

1. I am the Chauncey J. Medberry Professor of Management, Professor of Economics and Professor of Statistics at the University of California at Los Angeles. I earned a B.A. degree in Mathematics from Princeton University in 1966, and a Masters in Mathematics and a Ph.D. degree in Economics at the University of Michigan in 1970. I was an Assistant and Associate Professor of Economics at Harvard University from 1970 to 1975, and joined the Economics Department at UCLA in 1975 as a Full Professor. I served as Chair of the Department of Economics from 1983 to 1987 and Area Head of Business Economics from 1990 to 1993. I had a tenured appointment in the Economics Department at Yale University in 1995 and I have been a Visiting Professor at several universities, including the University of Chicago. I am a founding member of the UCLA Department of Statistics. I have been a Guest Professor at the University of Basel in Switzerland, at the Central European University in Prague, Czech Republic, at the Institute for Advanced Studies in Vienna, Austria, and at the Universidad de San Andreas in Buenos Aires, Argentina. I have served as the Director of the UCLA Anderson Forecast since 2000 and Chief Economist of the Ceridian-UCLA Pulse of Commerce Index from 2010-2012.

2. I have published extensively in the fields of econometric methodology and statistical analysis, in international economics, and in macro-economic forecasting. I have written five books and over 90 academic articles, many of which deal with the subject of inferences that may appropriately be drawn from non-experimental data. My academic research in econometrics and international economics has been profiled in **New Horizons in Economic Thought, Appraisals of Leading Economists**, edited by Warren Samuels. My papers in econometrics have been republished in a volume in the Edward Elgar Series: **Economists of the 20th Century**. My research has been funded by the National Science Foundation, the Ford Foundation, the Sloan Foundation, and the Russell Sage Foundation.

3. I am an elected Fellow of two of the most important honorific societies in my field: the American Academy of Arts and Sciences and the Econometric

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Society. I have been a consultant for the Federal Reserve Board of Governors, the Department of Labor, the Department of Energy, the International Monetary Fund, the World Bank, the Inter-American Development Bank, and the Treasury of New Zealand. I have been a visiting scholar with the Federal Reserve Board and the International Monetary Fund. I have served as an expert in a variety of matters dealing with issues of interpretation of data.

4. My curriculum vita is incorporated in this report as **Exhibit 1**. My testimonial experience is incorporated in this report as **Exhibit 2.** My hourly rate for time spent working on this matter is $700.

5. I have been retained by counsel for the indirect purchaser class plaintiffs in the *In re Lithium Ion Batteries Antitrust Litigation* to address whether econometric evidence common to the class can be used at trial in this case to show the effect, if any, of the alleged cartel on end-users who bought finished consumer products containing cylindrical lithium ion battery cells.[1] To answer that question, I have developed several statistical models based on the evidence available to-date. However, these models have been developed only to show the general ability of statistical modeling to answer the questions of impact and damages that I understand to be at issue in this case. Were I asked to perform the same exercise at trial, I would need to update these analyses to reflect any new relevant information that had become available. A list of documents on which I relied in the preparation of this report is provided in **Exhibit 3**.

6. **First,** I have been asked whether statistical methods common to the class can be used to confirm the existence of economic relationships among prices of lithium ion battery cells and packs such that the effects of the alleged collusion would have been broadly felt. Of course, it is not *necessary* for such relationships to exist for collusion to have widespread effect, but the existence of such relationships makes it likely that all or almost all product prices would have been impacted.

[1] My analysis is limited to cylindrical lithium ion battery packs and cells. I have not been asked to provide any opinions about other kinds of batteries, including polymer and prismatic lithium ion batteries.

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7. To address this question, I have first created data displays which illustrate the common movement of the prices of cylindrical cells and cylindrical cells in packs. The median of cylindrical cell prices, the 10^{th} percentile and the 90^{th} percentile move in parallel over time, as do quantity-weighted averages of product categories defined by the product characteristics which defendants have produced.

8. The common movement in prices over time is not by itself proof that the prices of these products are tied together either because of substitution on the demand side or the supply side, or because of a price-fixing conspiracy. This common movement could come instead from demand or supply factors which are common such as, for example, the price of cobalt or the Great Recession of 2008-09. I have therefore estimated regression models which explain the percentage change of prices of products (defined by part numbers) as a function of two other price variables and a set of controls. One explanatory variable is the percentage change over the same period of time of the average price of all the other products. This variable could capture common market effects but these are controlled for in two ways. First, I have included in the model variables that measure the common market effects that demonstrably affect prices, notably the cobalt price. Second, I have included another explanatory variable which is the lagged ratio of the price of the specific product divided by the average price of the other products. By design, this ratio nets out the common market effects and allows us to study what happens if the price of the product gets unusually high or unusually low compared with the average of the others.

9. I find that after controlling for (some) market effects, there remains a significant correlation between price movements of specific product and averages of price movements of the other products. I also find that when the price of a specific product is unusually high relative to the average of the other products, this tends to correct itself in the next period with weaker price movements of the specific product, thus reducing or eliminating the abnormality.

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10. I therefore conclude that there is ample statistical evidence of coordination of the prices of these cylindrical lithium ion battery packs and cells because of substitution on the demand side, substitution on the supply side, or because of the coordination that could come from a price-fixing conspiracy. This supports the conclusion that any price-fixing conspiracy would have effects that would spread broadly and would encompass all or almost all of the battery prices in the proposed class.

11. **Second,** I have been asked whether statistical methods common to the class can be used to measure the effect of the alleged cartel on prices of cylindrical lithium ion battery cells and packs. I have been asked to assume for the sake of this analysis that the alleged cartel began operation no later than January 1, 2000, and that it may have been in operation before that; I have also been asked to assume that it continued to operate through April of 2011.[2]

12. To address this question I have estimated regression models that explain the movement of prices of cylindrical cells and cylindrical packs as functions of supply and demand variables and also conspiracy indicators. The two salient features of these battery prices are a downward trend, with or without quality controls, and an upward price hump in the midst of the Great Recession.

13. The long-term downward trend in battery prices is explained in my model by the long-term downward trend in the producer price of portable computers, which is symptomatic of the technological improvements that have driven down prices of many consumer electronic products. In a tech sector with a high rate of innovation, a successful "price-fixing" conspiracy need not actually raise prices; it is enough to slow the rate of descent. The model includes this as a possibility.

14. The second salient feature of cylindrical lithium ion batteries (LIB) prices is the price hump in 2008-2009. This is explained in the model by the rise in cobalt

[2] Although I have not been asked to provide an opinion specifically on the question of the cartel, I have reviewed enough evidence relating to the cartel to be comfortable that these dates are legitimate assumptions for purposes of this preliminary analysis. This includes the complaint, the summary of evidence contained in the report of Dr. Abrantes-Metz, and other evidence cited herein or in Exhibit 3.

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prices about six months earlier. Another way a price-fixing conspiracy could have operated is through the enhanced ease-of-coordination created by the rise of cobalt prices in the Great Recession which would otherwise have put downward pressure on prices, making it difficult to pass on the added price of cobalt to customers. There is considerable documentary evidence that the defendants discussed with each other how to deal with the rise in cobalt prices. The battery price models that I have estimated thus measure whether there was increased effectiveness of the conspiracy from April 2007 through December 2009 related to these collusive communications.

15. I find that LIB prices were higher during the conspiracy period than can be explained by the cobalt price, technological trends or macro economic variables. This estimated effect is substantial for both cells and packs, and very statistically significant for packs and less so for cells. I attribute this to the conspiracy. I find that the impact of cobalt prices on battery price was substantially and statistically greater for both cells and packs during the period of elevated cobalt prices from April 2007 to December 2009, than during other periods of time. I also attribute the increased sensitivity of battery prices to cobalt prices during this period of time to the conspiracy. I find that the macro-economic variables call for weaker pricing during the Great Recession, absent the conspiracy. The estimated conspiracy effects support the conclusion of overcharges of 18.6 percent for cylindrical LIB cells and 13.9 percent for cylindrical LIB cells that were sold in battery packs.

16. **Third,** I have been asked whether evidence common to the class, including economic theory and statistical methods, can be used to demonstrate whether and to what extent the alleged cartel caused the price of finished consumer products such as notebook PCs and power tools to be increased, as a result of increased prices for cylindrical lithium ion battery packs and cells.

17. I have reviewed the extensive theoretical literature that addresses the pass-through question: to what extent is an increase in costs (e.g. battery prices) passed on to buyers. All of the economic models I have reviewed have some pass-through, and consequently the focal point of this literature is not zero pass-through but 100 percent. The focal question is: what are the

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circumstances in which overshifting would occur (more than 100 percent pass-through) and what are the circumstances in which undershifting would occur? The fixed costs (R&D) in the battery business together with the product differentiation of the industry tend to favor overshifting, but the theory is far from conclusive, and empirical evidence is essential to help determine the amount of pass-through in the circumstances of this case.

18. The empirical literature on pass-through reviewed here, like the theoretical literature, is far from determinative. Different data sets describing different circumstances support different estimates. Fortunately, we have been able to study some specific information regarding costs of goods sold and the corresponding sale prices of notebooks, camcorders, cameras and power tools containing LIBs. These data come from seven OEMs, three distributors, and nine retailers. A statistical comparison of prices and costs separately for these nineteen different entities selling four different types of products supports the use of 100 percent pass-through. Many of the confidence intervals for the pass-through rates include 100 percent. Some intervals fall short of 100 percent (supported a lower pass-through rate) but a larger number of intervals exceed 100 percent.

19. The price and cost comparisons used to produce the pass-through estimates described in the previous paragraph often involve large differences in costs, but the changes in battery prices that might be passed on to finished product buyers can be small compared with the price or cost of the product. There is consequently a need to find pass-through rates either specifically for batteries or for small changes in costs. Toshiba has provided a data set for notebook computers that separates the battery cost from the other costs. In my study of this data set I find that the estimated pass-through of battery prices is compatible with 100 percent pass-through.

20. It is possible that small changes in costs may not be fully passed on to buyers, but economic theory suggests that the small-change effect can go either way: overshifting as well as undershifting. I have attempted to shed light on the difference between pass-through of large cost changes and small cost changes by estimating a model that connects the price of finished products containing

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cylindrical LIBs to unit costs that vary over time, and I allow the responsiveness to large cost changes to be different from the responsiveness to small cost changes. With this data set I find no statistically significant evidence that the responsiveness to small price changes is less than to large price changes.

21. This pass-through discussion is summarized in a single number: 100 percent pass-through. We do not now have reliable evidence that would allow a damage estimate based on different rates of pass-through for different products and different sellers. Absent that evidence, I use 100 percent in this report, but reserve the right to revise the treatment as needed pending receipt of additional relevant information.

22. **Fourth,** I have been asked whether these methods allow me to calculate a preliminary estimate of the harm caused to the class by the cartel. They do. I estimate that harm to be $967 million, assuming a class of all indirect purchasers of finished products containing cylindrical LIBs in the United States.

II. Cylindrical Lithium Ion Batteries Industry

23. Cylindrical lithium ion batteries are a type of lithium ion rechargeable battery[3] that have become widely used in portable consumer electronics industry, particularly for notebook computers but also camcorders and power tools.

24. Rechargeable batteries vary in their functional characteristics, e.g., their capacity for storing energy and their form factors.[4] LIBs' key advantages over other rechargeable battery types include higher energy density, lack of memory

[3] Lithium ion battery cells also come in prismatic and pouch/polymer forms and these forms are typically used in cell phones or tablet PCs.

[4] See David Linden and Thomas B. Reddy, Handbook of Batteries, 3rd ed (New York: McGraw-Hill, 2001), 574-575.

effects (the tendency for a battery to not recharge fully if it was previously only partially charged), and high charge and low self-discharge rate.[5]

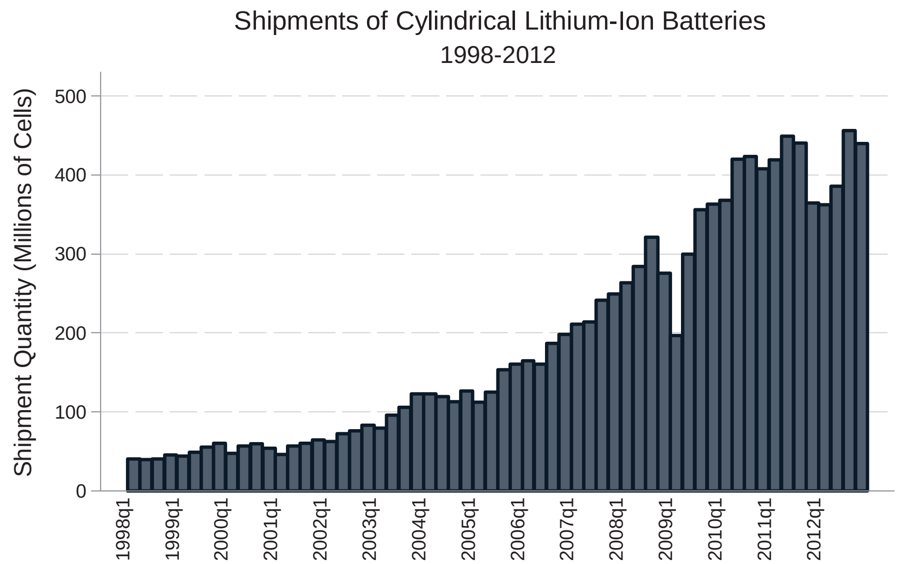
25. Cylindrical LIBs have excellent characteristics for end-use applications relative to other types of rechargeable batteries and are more economical to produce. As described below, other types of rechargeable batteries were not generally economically viable substitutes for cylindrical LIB, particularly for notebook computers which is the major use of cylindrical LIBs.

26. Sales of cylindrical LIBs grew substantially during the relevant period. In 1998, annual unit sales were approximately 150 million LIB cells. By 2011, annual sales had grown by a factor of 10 to 1.8 billion cells sold worldwide.[6]

[5] Additional advantages are that unlike some rechargeable batteries (e.g., lead acid and NiCd), Lithium ion batteries do not contain toxic heavy metals (Lightning Global, "Lithium-ion Battery Overview," *Technical Notes* Issue 10 (May 2012) and LIBs hold a charge especially well, i.e., their rate self-discharge is less than half NiCd batteries. *See also*, Pandit G. Patil, "Developments in Lithium_Ion Battery Technology in The Peoples Republic of China," Argonne National Laboratory (January 2008); Masashi Mori and Takato Watabe, "LiB Materials Industry," Deutsche Bank Group, January 26, 2011 ("Deutsche Bank 2011 Report"); LGC-MDL0643671, at 5-6.

[6] SONY-LIB-000893992. at tab "Shipment"

Figure 1



Source: IIT LISHIP 2011 Data (SONY-LIB-000893992.xls) and LGC-MDL0239585.

A. Lithium Ion Cell Types

1. Cells and Packs

27. A cylindrical LIB cell contains certain basic components necessary to store and retrieve electricity: electrodes, a separator, and electrolyte.[7] A cylindrical LIB pack is an arrangement of battery cells and electronics that control and protect the cells in a housing.[8] A battery pack can have as few as one cell.

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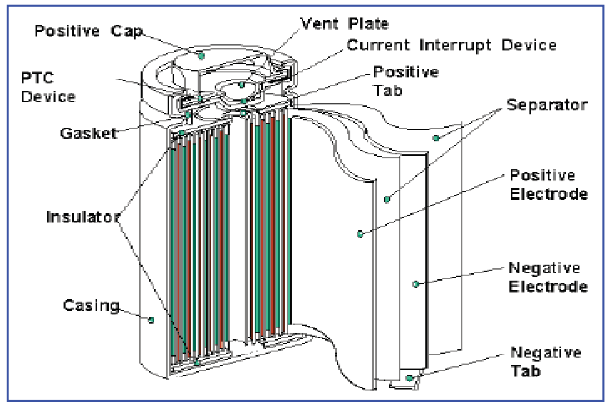
[7] Electrodes can be broken down into the anode and cathode, which give and receive electrodes from an external circuit. The electrolyte provides a mechanism for charge to transfer between the anode and cathode. *See* David Linden and Thomas B. Reddy, Handbook of Batteries, 3rd ed (New York: McGraw-Hill, 2001), 20-21.

[8] "A *battery* consists of one or more electrochemical cells, electrically connected in an appropriate series / parallel arrangement to provide the required operating voltage and current levels, including, if any, monitors, controls and other ancillary components (e.g. fuses, diodes), case, terminals and markings." David Linden and Thomas B. Reddy, *Handbook of Batteries*, 3rd ed (New York: McGraw-Hill, 2001), 20.

2. LIB Cells

28. The fabrication of cylindrical LIB cells involves mixing and coating electrode materials, which are then wound into a cylinder.[9]

Figure 2 : A Cylindrical Lithium Ion Battery Cell[10]



29. The size of a cylindrical cell is described by a number reflecting a diameter and a length.[11] There are a variety of cylindrical sizes but, as shown in Figure 3, the 18650 (approximately 18mm in diameter and 65 mm in height) accounted for the vast majority of sales.

30. Figure 4 summarizes the shipments of cylindrical LIB cells by cell diameter in the Defendants' sales data. Sales of diameter 18 mm cells, which exceeded 100 million per quarter beginning in 2007, are more than ten times the next highest volume size, diameter 14 mm. Sales of size 17 mm, once the second most common, essentially disappeared as 18 mm grew.

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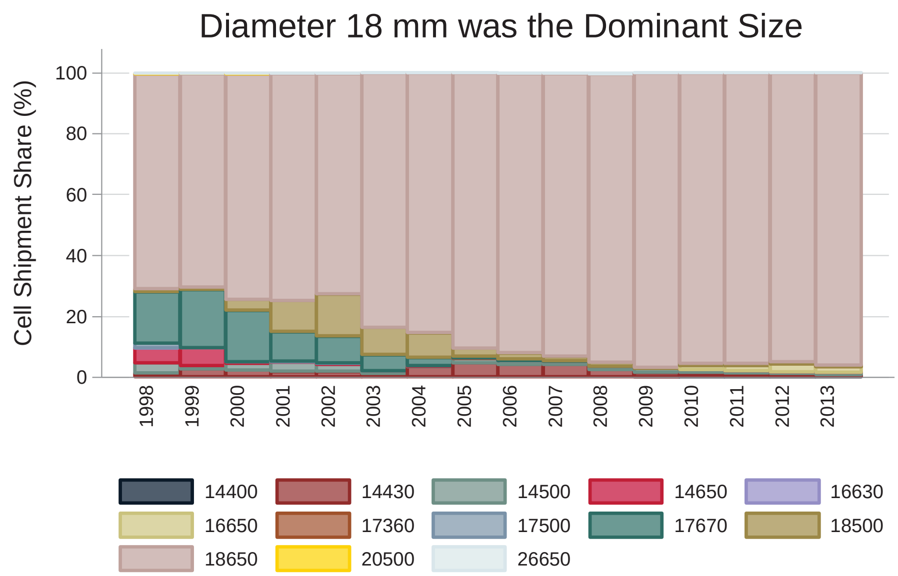
[9] Kazuo Tagawa and Ralph Brodd, "Production Processes for Fabrication of Lithium-Ion Batteries," in Lithium-Ion Batteries – Science and Technologies, ed. Ralph Brodd et al., (Springer, 2009), 181-194.

[10] PNA0063173 at 5-6. See also "BU-301a: Types of Battery Cells," Battery University, http://batteryuniversity.com/learn/article/types_of_battery_cells

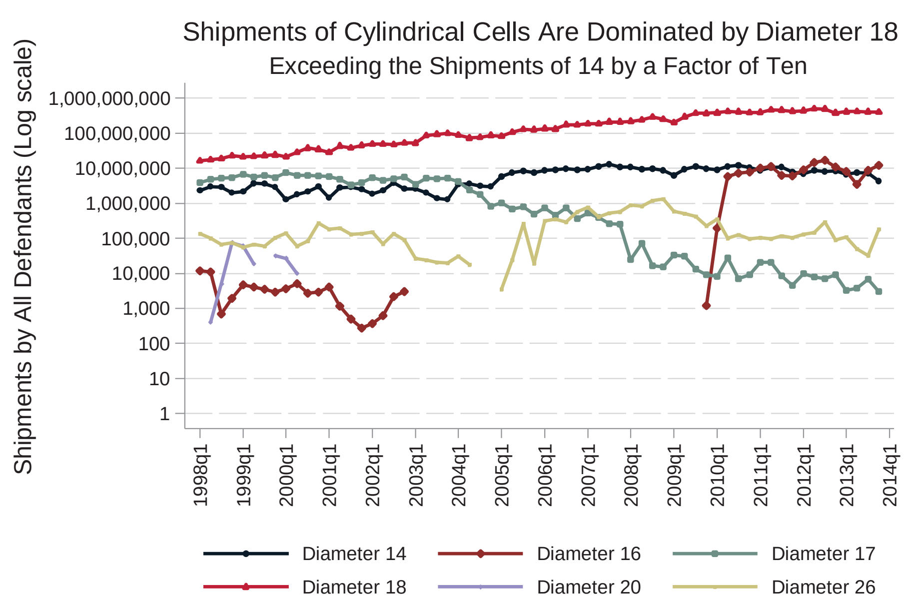
[11] See e.g., HML-P-015965 at 978.

Figure 3



Note: Packs are represented here by number of cells per pack.
Soure: Defendant Transactional Sales Data

Figure 4



Source: Defendant Transactional Sales Data.

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3. Cell Capacity and Energy Density

31. Capacity is the total amount of power a battery can produce before being recharged. It is typically measured as the time (hours) for which the battery can sustain a unit of power output (amps or watts). Thus a battery's capacity may be described as, e.g., 2200 mAh (2200 hours of output of a milliamp). Capacity is most often reported as "typical" or actual capacity. However, capacity can vary depending on environmental circumstances such as the temperature the battery is kept at. Accordingly, some manufacturers report a lower "minimum" capacity. Minimum capacity is generally about five percent lower than the typical capacity for the battery.[12]

32. A cylindrical LIB cell's energy density is closely related to its capacity except that rather than just reflecting the total power output over time, density measures the total power capacity per unit of the cell's mass or volume. For example, density per unit of mass is often presented as Wh/kg.[13]

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[12] See e.g., SANYO0136494 at 506.

[13] See e.g., LGC-MDL0643671 at 4.

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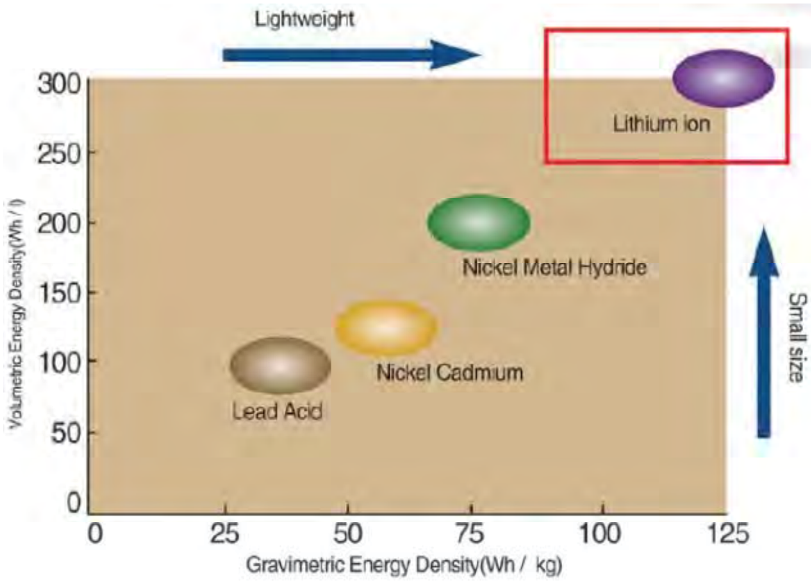
Figure 5: Energy Densities of Secondary Battery Types[14]



4. Other Characteristics

33. Other functional characteristics which may contribute to the pricing of batteries are power output and voltage. I understand that these characteristics are largely determined in cells by LIB cathode material but may also be altered by pack electronics and cell configuration. For example, there were some 18650 cylindrical cells that were developed to have increased power output (principally for use in power tools).[15] These high power output (amperage) products also tended to have lower capacities, but this high power/low capacity battery has a relatively high price. Other cylindrical LIB cells may have been designed to have an extra-long storage life or greater safety.[16]

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[14] LG Chem Power Inc, "LG Chem Power Inc, High-powered high-capacity lithium ion batteries," http://www.lgcpi.com/lithium.shtml.

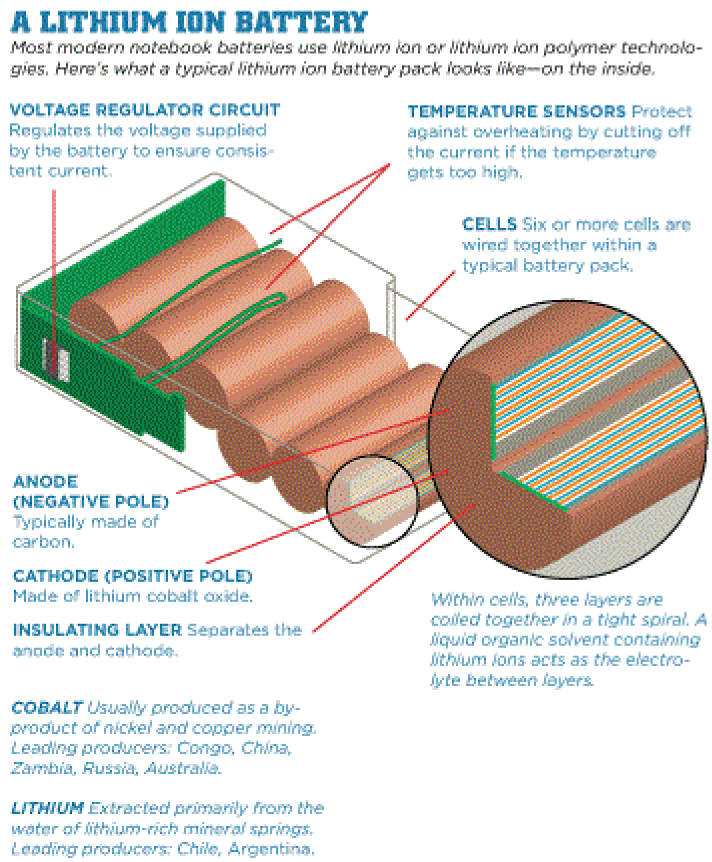
[15] See e.g., LGC-MDL0239585 at 596 (Table showing low mAh, high amperage cylindrical labeled "PT" in LGC roadmap)

[16] SANYO-C000154182 - 4210 at 184 – 185.

B. LIB Battery Packs

34. Cylindrical LIB cells must be fabricated into a pack before they can be used in a finished product. Cylindrical cells are typically fabricated into packs of two or more cells (and often six or more). A lithium-ion battery pack contains one or more individual cells packaged together with additional electronics to assist with its performance (e.g., to protect against overcharging).

Figure 6 : A Cylindrical Pack[17]



35. The cells in a pack can be connected electronically in several ways. By connecting cells in parallel, designers increase pack current or power output (wattage). By connecting cells in series, designers increase pack voltage. By

[17] Dylan Tweney, "What's Inside your Laptop?" *PC Magazine*, March 14, 2007.

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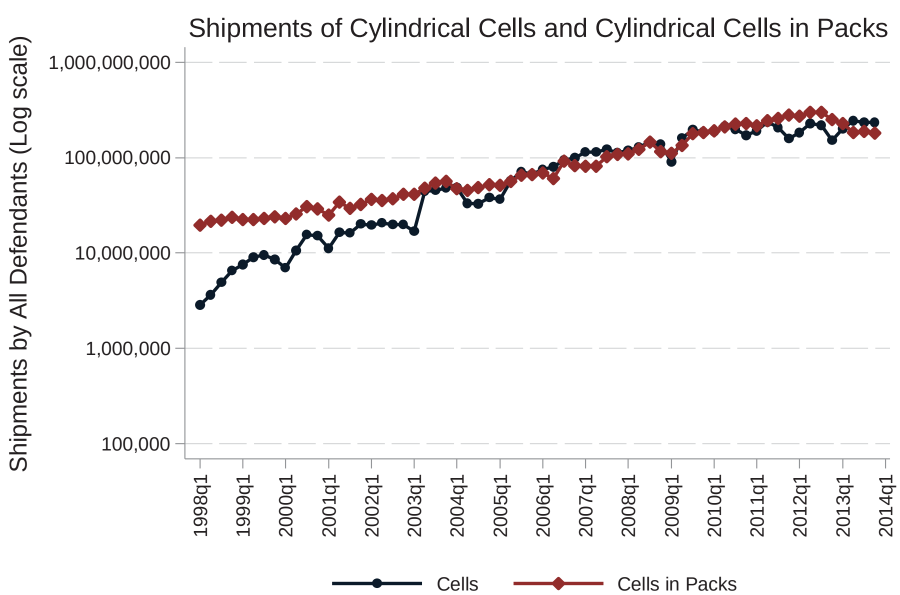
using both serial and parallel connections, manufacturers have additional flexibility on how to achieve the voltage or current requirements.[18]

36. Manufacturers sold cylindrical LIBs as individual cells as well as battery packs ready for use in finished products. The figure below illustrates the quantities shipped of cylindrical cells and cylindrical cells in packs with a logarithmic scale which turns constant rates of growth into straight lines. In the earlier period, manufacturers' sales were usually of LIB packs rather than of LIB cells (see also Figure 8 below), but from 1998 to 2008 pack sales grew more slowly. Subsequently, similar and slower rates of growth were experienced by both. Neither the U.S. recession of 2001 nor the U.S. recession of 2008-09 had a dramatic effect on the growth of sales volumes.

Figure 7



Source: Defendant Transactional Sales Data.

[18] "BU-302: Serial and Parallel Battery Configurations", Battery University, http://batteryuniversity.com/learn/article/types_of_lithium_ion

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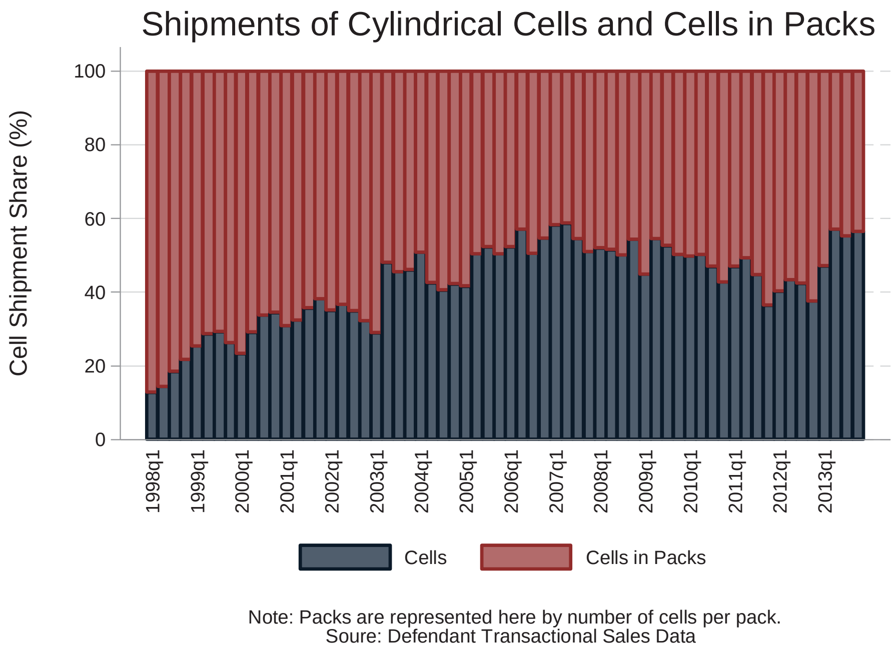
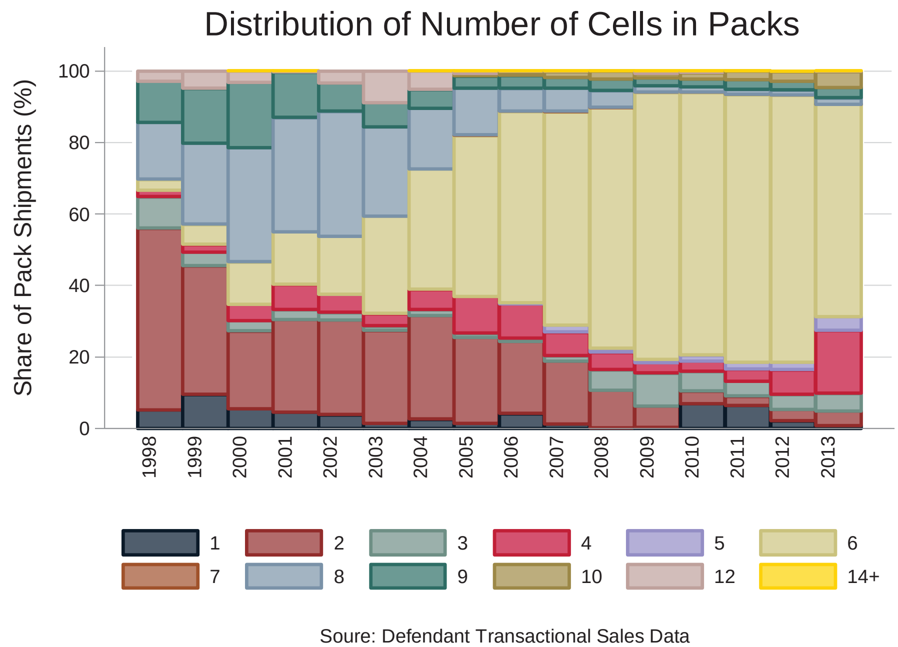
Figure 8



37. As shown in Figure 9, a cylindrical LIB pack sold by manufacturers typically had two to eight cells in the pack. There were single cell packs and packs with 14 or more cells also, but these were less common.

Figure 9



38. The battery pack is considered an essential component in portable electronic products because the mobility or portability of the product depends on how long the battery can last without being charged. With respect to notebook PCs, analysts routinely compare and rank battery life among different products and review their reliability.[19]

C. Production Cost and Technological Progress

39. Industry analysts estimated that material costs were generally the majority of variable LIB cell costs.[20] This is consistent with manufacturer data. Samsung's cylindrical LIB cell cost data (available only from 2007 to 2014) indicates that

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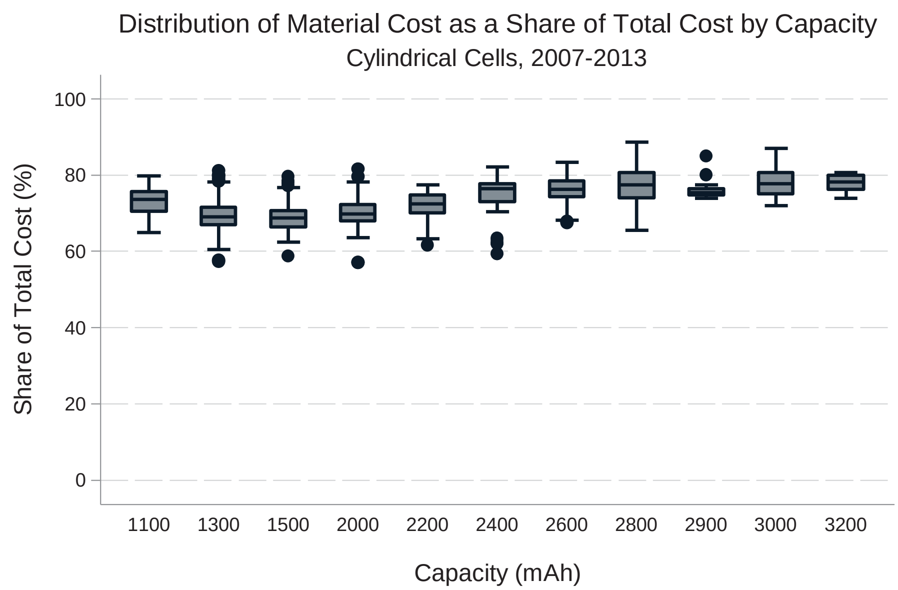
[19] See eg, Craig Sims, "Laptops with Longest Battery Life - 2012," *CNET*, October 22, 2012; Michael A. Prospero, "Laptops with the Longest Battery Life," December 21, 2015; Michael A. Prospero "Short Battery Life sinks First Windows 8 Notebooks," *Laptop*, December 14, 2012.

[20] See e.g., Citi Research, "Lithium-ion batteries, A Japanese tech growth story?," July 20, 2012 at 54. See also LIB Materials Market Bulletin 10Q3 in *IIT LIB-related Study Program 10*-11, (August 2010): 2 and LGC-MDL0098654.

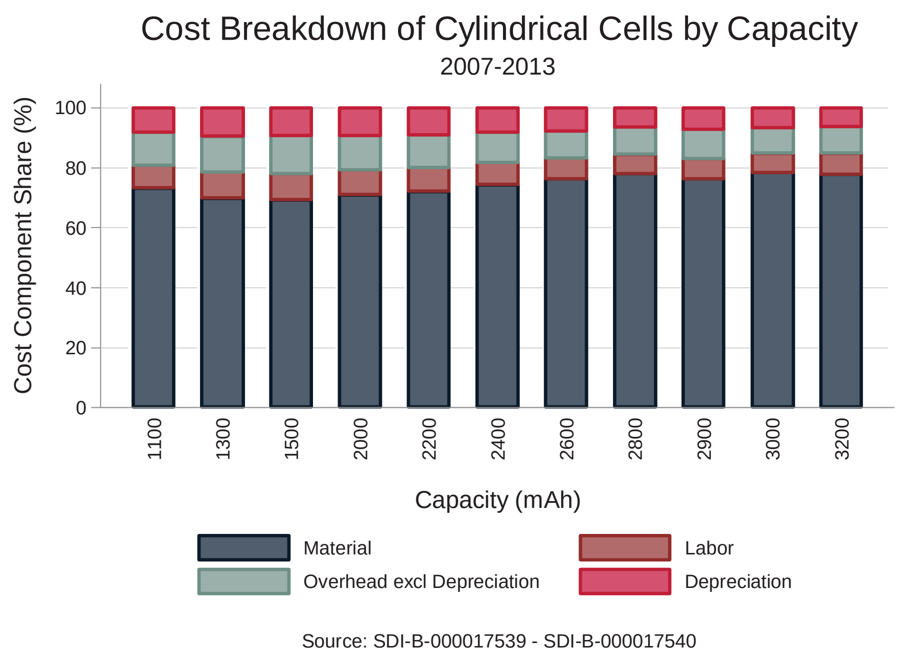
material costs were a consistently large fraction of cell costs. See Figure 10 and Figure 11.

Figure 10: Samsung's Share of Material Cost in Total Cost



Source: SDI-B-000017539 - SDI-B-000017540

Figure 11 : Samsung Cost Composition



40. Of these LIB cell costs, the material used for battery cathodes was of central importance. Materials, especially cobalt, were critical because cylindrical LIB energy capacity and technological advances in capacity depended on the materials used for battery cathodes. During the 2000s, manufacturers used a variety of lithium compounds in cylindrical LIB cells.[21] The standard cathode material was lithium cobalt oxide (LCO).[22] LCO as well as other high energy density cathode materials contain cobalt (e.g., NMC or NCO).[23] Thus cobalt was a major cost factor in LIB manufacturing. Cobalt prices, see Figure 12, were quite variable over the relevant period, including a price peak of $48 per pound in 2008 surrounded by price troughs of $15 or less in 2006 and 2009. Cobalt was described in industry and manufacturer documents as being of

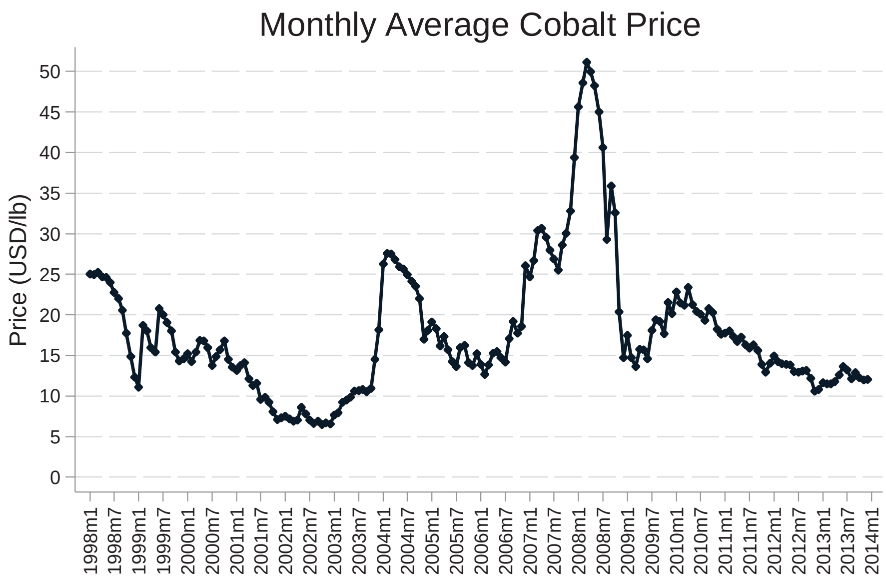
[21] See Citi Research, "Lithium-ion batteries, A Japanese tech growth story?", July 20, 2012, 33-34.

[22] PNA0063173 at 7.

[23] The importance of nickel in electrode materials has increased in recent years. See e.g., Citi Research, "Lithium-ion batteries, A Japanese tech growth story?," July 20, 2012, 20-21.

particular importance in cylindrical LIB pricing.[24] Indeed, manufacturers discussed cobalt price movements with customers and used cobalt price increases as a justification/explanation for battery price increases.[25]

Figure 12



Source: London Metal Exchange Data from LGC-MDL0002342, P-DOJ0099116 and minerals.usgs.gov

41. During the class period higher capacity cylindrical LIB cells were introduced and grew in sales. Figure 13 below shows industry sales in 200 mAh ranges of cell capacities during the class period, including 2400-2600, 2600-2800, 2800-3000, and 3000-3200 mAh. Although some lower capacity cylindrical LIB cells faded from use as they were replaced by these higher capacity cells, for example, cells in the 1800-2000 mAh range, other capacities such as those between 2000-2200 mAh persisted and some low capacity cells, for example those in the range 1600-1800 mAh, experienced growth.

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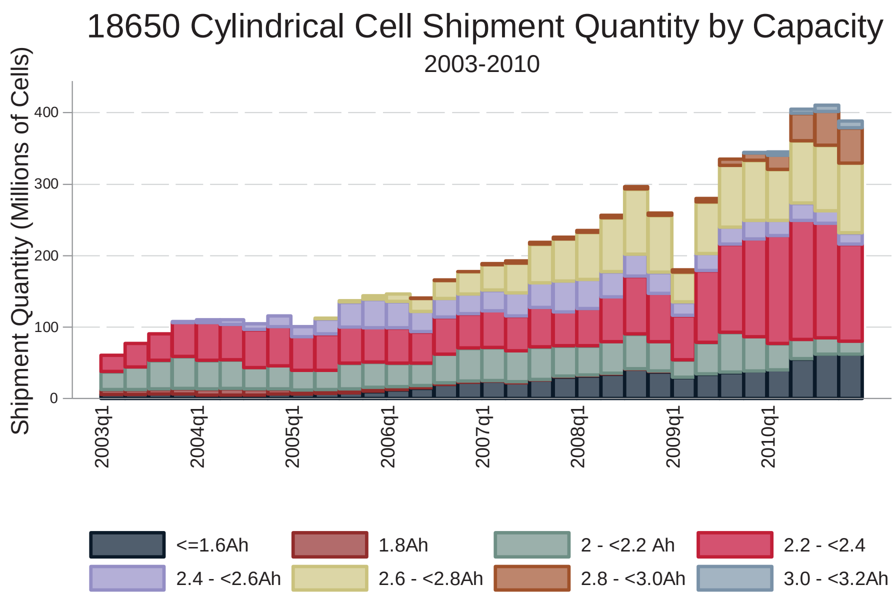
[24] "BU-205: Types of Lithium-ion", *Battery University*, http://batteryuniversity.com/learn/article/types_of_lithium_ion; LGC-MDL0299622 and SANYO-C000300077.

[25] See e.g., SANYO-C000037345 at 11, 29-30 and SANYO0438644 at 17-18.

Figure 13: Larger Capacity Cells Have Grown More Predominant



Source: IIT LICAPA 2011 Data (SONY-LIB-000332309.xls).

42. Some lower capacity cylindrical batteries were introduced with higher power output, primarily for power tool applications. For example in June 2009, Sony introduced a "high power, long-life" cylindrical battery that was geared towards power tool uses with high power output requirements.[26] Samsung and other manufacturers also developed lines of high power output cylindrical cells.[27]

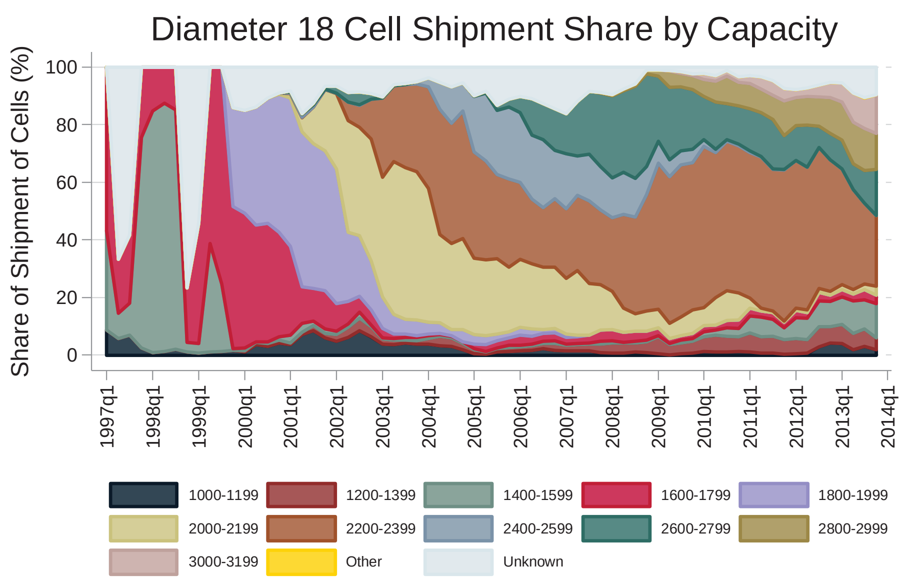
43. Figure 14 below illustrates the shipment shares of the high-volume capacities of diameter 18 cylindrical cells (18650 plus other less common 18mm diameter sizes) from the transactional sales data. Consistent with the industry sales data, we see the technological progress which allowed greater energy to be stored in the same size cylindrical cell. Cells with capacity 1800 up to 2000 mAh were dominant in 2000 but declined in share after 2001 when 2200 mAh was

[26] SONY, "Sony Launches High-power, Long-life Lithium Ion Secondary Battery Using Olivine-type Lithium Iron Phosphate as the Cathode Material," August 11, 2009.

[27] See e.g., SDI-B-000039415 at 419 and SANYO-C000154182 at 184 – 185.

introduced. Similarly, other higher capacity cells were introduced in the years that followed.[28]

Figure 14



Note: Packs are represented here by number of cells per pack.
Source: Defendant Transactional Sales Data

44. Similar changes occurred in capacities of diameter 14 cylindrical cells sold during this period. There as well, higher capacity cells were introduced over time, though increased volumes of lower capacities offset somewhat the shift toward the higher capacities.

45. Figure 15 shows the overall change in energy capacity for diameter 18 mm cells and 14 mm cylindrical LIB cells (the next largest volume size, though far less than 18 mm). The quantity weighted average capacity in mAh of diameter 18 cells rose from 1997 to 2008 after which it declined slightly. The change in average capacity in mAh of diameter 14 mm cells has some slight rise, especially after 2010.

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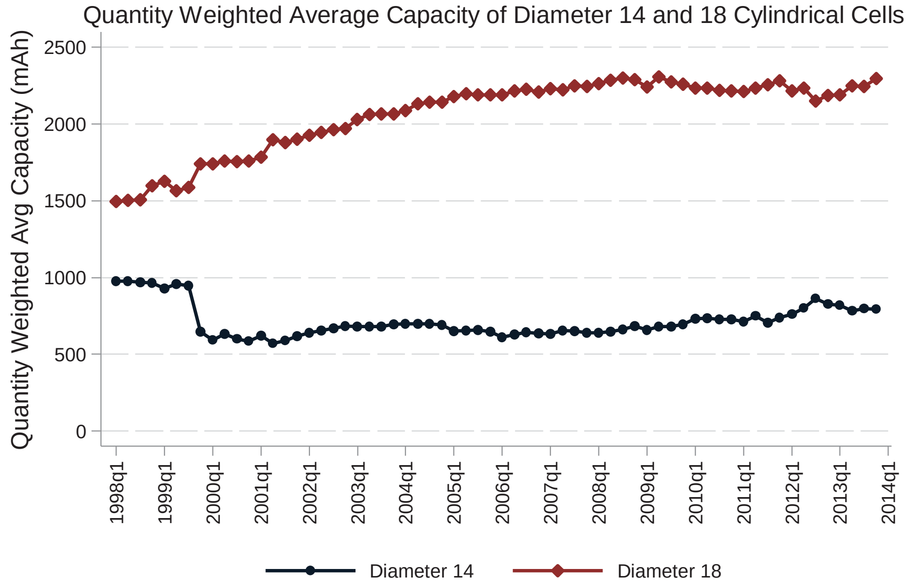
[28] 2400 mAh cells made inroads towards the end of year 2003, 2600 mAh around 2005, 2800 mAh about 2008 and 3000 mAh in about 2009.

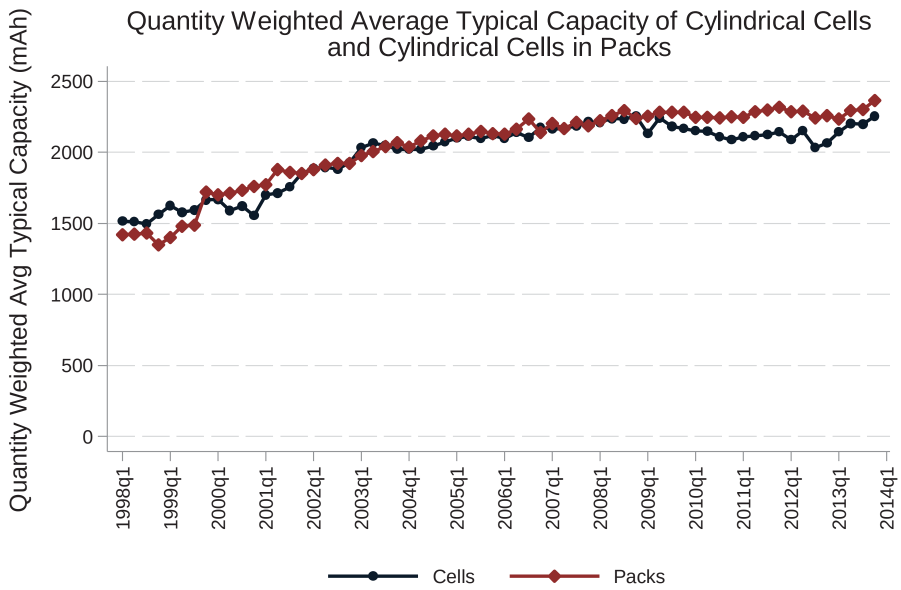
Figure 15



Source: Defendant Transactional Sales Data.

46. Figure 16 shows the quantity weighted average capacity (typical mAh) of sales of cylindrical cells and cylindrical cells sold in packs. The rate of technological improvement of these batteries as measured by the increase in average energy capacity was greatest from 1997 to 2003, and somewhat slower from 2003 to 2008. After 2008 there was a bit of a divergence of cells and packs, with continued increases in average capacity for packs but not for cells.

Figure 16



Source: Defendant Transactional Sales Data.

D. LIB Manufacturers

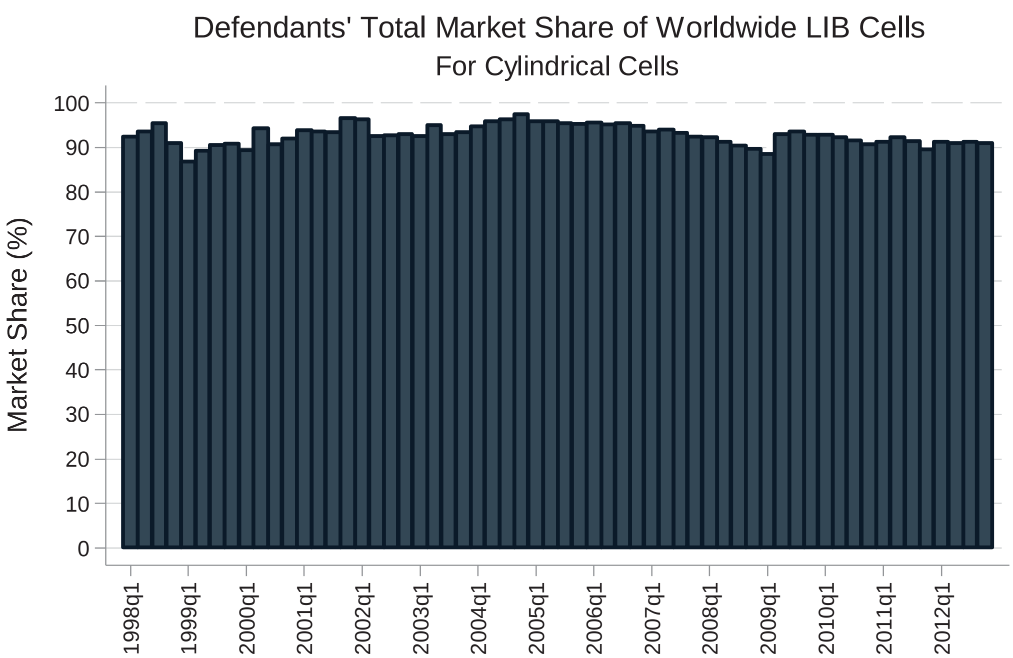
47. Japanese firms such as Panasonic, Sanyo, and Sony created the first LIBs that were successful in consumer electronics. South Korea's Samsung (SDI) and LG Chem (LGC) entered the lithium-ion battery industry in the late 1990s: LG Chem began mass production of lithium-ion batteries in 1998, followed by SDI in 2000.[29] Chinese firms, such as BYD and BAK, entered the lithium-ion battery industry after 2000.[30] As shown in Figure 17 Defendants combined

[29] "Company History," Panasonic Batteries Site, http://panasonic.net/energy/battery/about_us/history/; "Keywords to understanding Sony Energy Devices," Sony Energy Devices Corporation, http://www.sonyenergy-devices.co.jp/en/keyword/; "High Capacity Li-ion batteries(Lithium Ion Battery Cells)," Samsung SDI, http://www.samsungsdi.com/lithium-ion-battery/overview; "LG Chem Power (LGCPI) FAQ," LG Chem Power, http://lgcpi.com/technology/faq/

[30] Pandit G. Patil, "Developments in Lithium-Ion Battery Technology in The Peoples Republic of China", *Argonne National Laboratory* (January 2008), 22-24; "South Korea Invests to Become Dominant in Li-Ion Batteries," busworld (July 15, 2010), http://www.busworld.org/articles/detail/955; "Global Li-ion Battery Market for Consumer Electronics 2015-2019," PR Newswire, http://www.prnewswire.com/news-releases/global-li-ion-battery-market-for-consumer-electronics-2015-2019---key-vendors-are-byd-lg-chem-panasonic-samsung-sdi-shenzhen-bak-sony--tianjin-lishen-battery-300119597.html ; Laura Wood "Li-ion

market share exceeded 90 percent of sales of worldwide cylindrical LIB during the entire Class Period.

Figure 17



Note:Panasonic acquired Sanyo in December 2009.
Source: IIT LISHIP 2011 Data (SONY-LIB-000893992.xls) and LGC-MDL0239585.

III. An Exploration of Cylindrical LIB Pricing

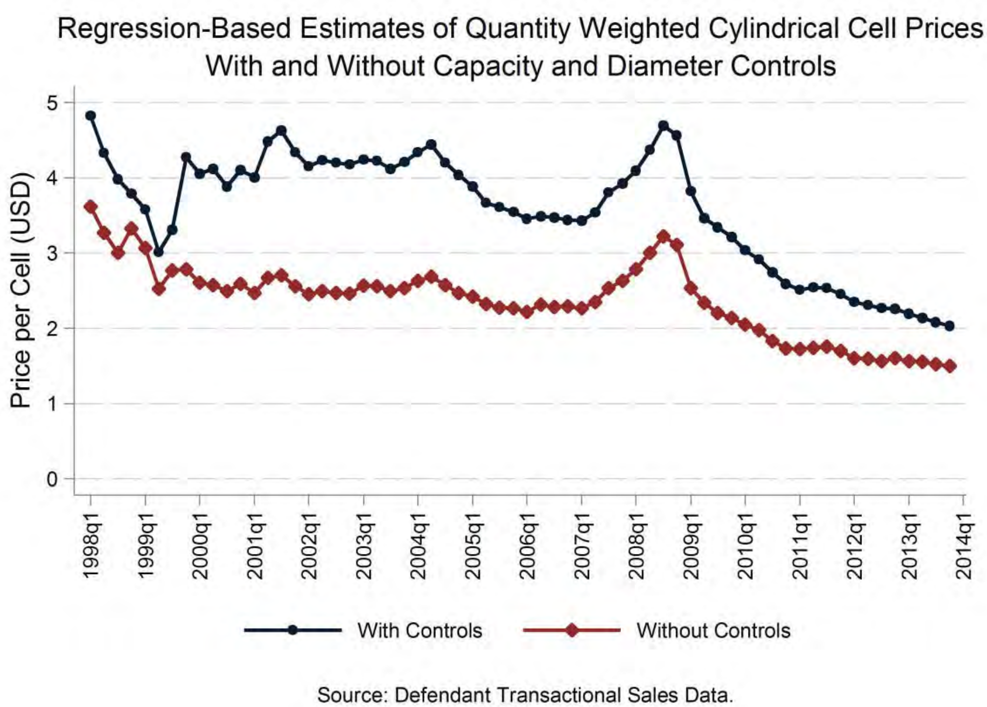
48. Figure 18 shows two quantity-weighted average price series derived using two exploratory regression equations (one with and one without controls for capacity and diameter).[31] Compared to the price series that lacks controls for characteristics, the price series that controls for characteristics changes reveal an unusual drop and recovery in prices in 1999, which presumably is masked in the uncontrolled series by changes in the characteristics of products sold. Except for that difference, the similarity in overall shapes of these two figures

Batteries Hold 80% of the Chinese Mobile Phone Battery Market," Business Wire, August 29, 2006.

[31] These are found with a weighted regression of the logarithm of transaction prices on indicators for quarter and for characteristics with weights equal to cell volume.

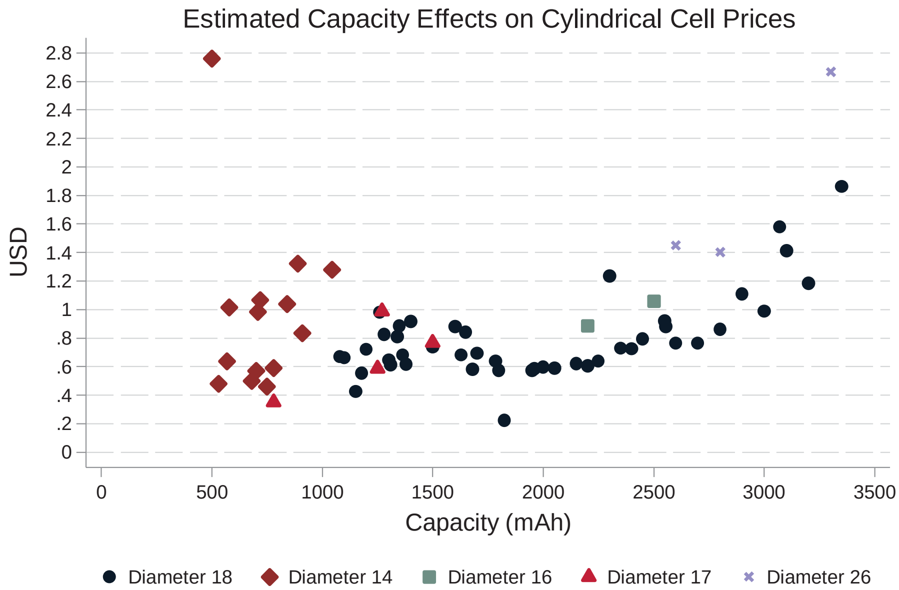
suggests there was very little shift over time toward more valuable capacities or more valuable diameters. Thus if quality improvement is masking a steeper underlying decline in prices, that improvement is not in capacity or cell diameter.

Figure 18



49. Figure 19 below illustrates the estimated price multiplier that applies to a cell's capacity in the battery price regression described in the previous paragraph, which has controls for each capacity and diameter combination. The marginal impact of capacity on cell prices becomes clearest for capacities higher than 2000 mAh. Since the average capacities don't begin to exceed 2000 until after 2006, this may be the reason the capacity controls do not have more effect on the quality-controlled prices discussed above.

Figure 19



Source: Defendant Transactional Sales Data.

50. Although it would be useful to connect statistically manufacturing costs with battery prices, the cost data which we have received from the defendants apply to a limited period, and vary in scope and type of costs reported. SDI labor and materials costs which we have received are displayed in Figure 20 along with the price of cobalt. This SDI data from 2007 to 2014 suggests several things. First, labor costs were small and stable over this period, and not likely an important driver of changes in battery prices. Second, the general decline in materials costs from $1.50 in 2007 to $1.00 in 2014 could support a $0.50 decline in cell prices. Third the 2008 peak and 2009 valley in cobalt prices are evident in the material costs but only with a bump up about six months after the cobalt price peak, and no subsequent valley. This suggests that the accounting for swings in cobalt costs is not done with mark-to-market accounting, but uses instead something like average acquisition costs for the existing SDI cobalt inventory. Fourth, the decline in cobalt prices after 2010 parallels the decline in material costs and may be an important driver of declining costs. Thus, at least for this period of time, the cobalt price with some smoothing and delay appears to be a good substitute for materials costs,

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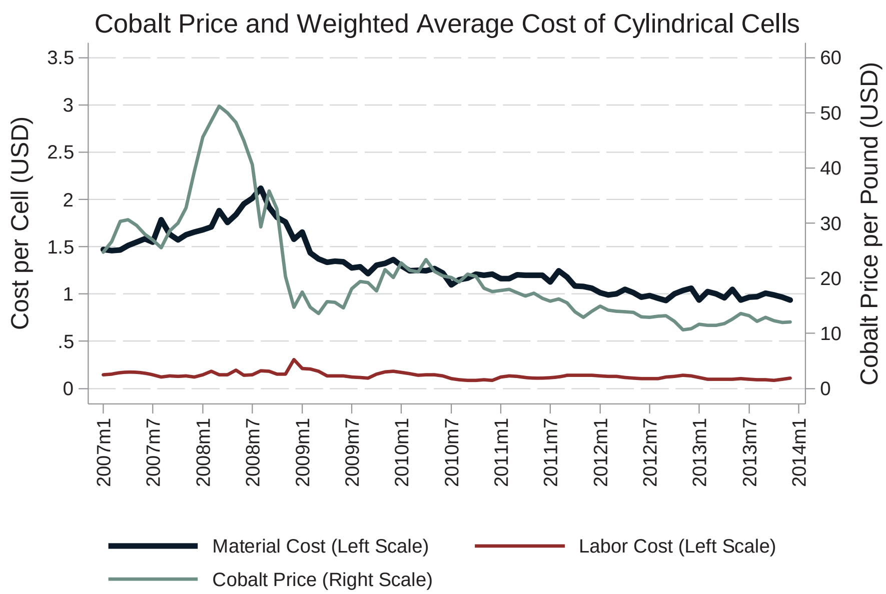
though during other intervals of time, changes in the amount of cobalt per cell may also be important.

Figure 20: SDI Labor and Materials Cost, and Cobalt Price



Source: SDI-B-000017539 - SDI-B-000017540, Defendant Transactional Sales Data.

51. A connection between battery prices and cobalt prices is revealed in Figure 21 which compares the price of cobalt with the price of cylindrical cells of diameter 18 and capacity 2000 mAh, thus holding fixed the "quality" of the battery. The spike in the price of the cells follows the spike in the cobalt price in 2008 which suggests that by accounting for a delayed effect, cobalt prices may help explain at least the 2008 price rise. There is also a spike in cobalt prices in 2004 which is associated with a cell price above the trend line shortly after the cobalt price spike. Therefore, this image confirms the information above that suggests cobalt prices may be an important determinant of cylindrical LIB prices.

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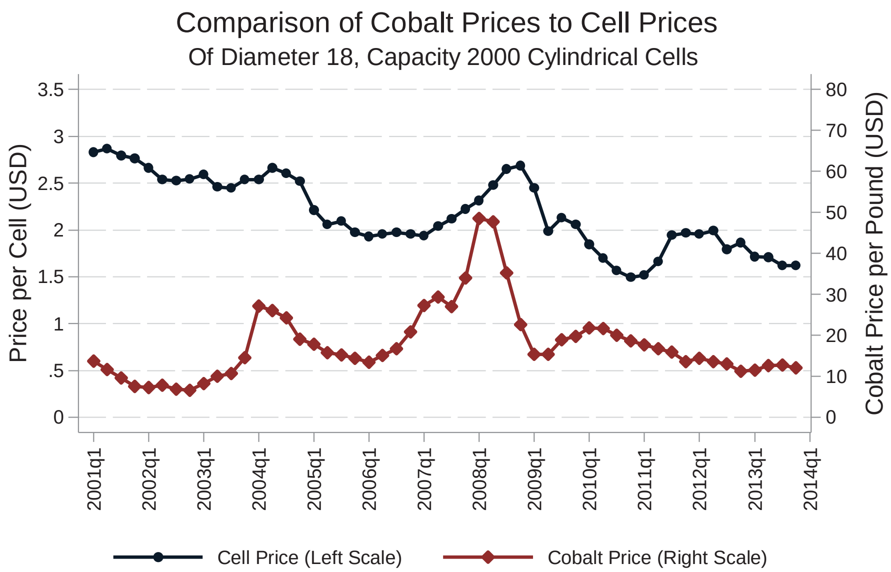
Figure 21



Source: Defendant Transactional Sales Data,
London Metal Exchange Data from LGC-MDL0002342, P-DOJ0099116 and minerals.usgs.gov.

52. Figure 22 below illustrates the prices of cylindrical LIB cells and the price per cell of packs containing cylindrical LIBs. As might be expected the prices of cells and packs behave very similarly.

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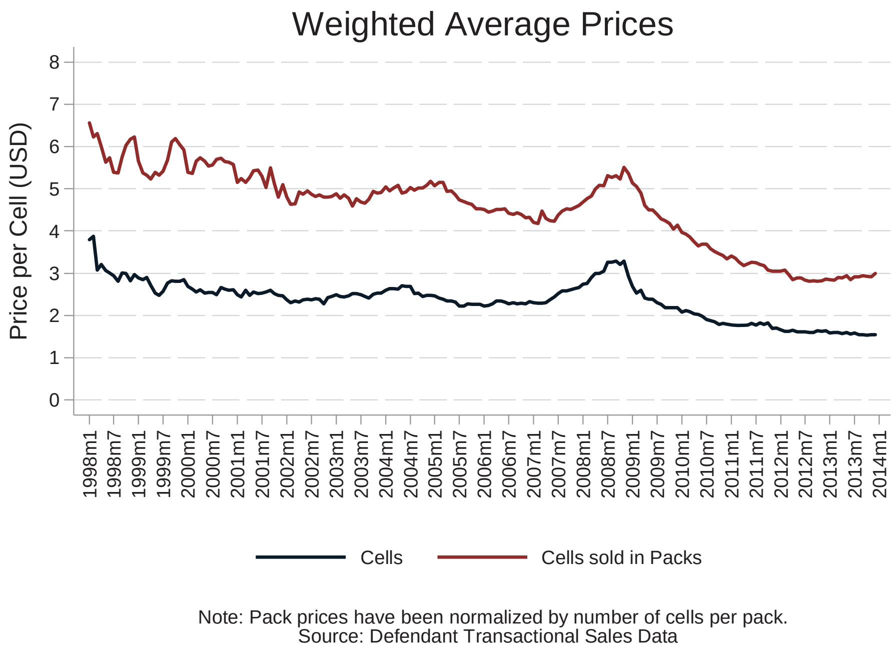
Figure 22: Prices of Cylindrical LIB Cells and Cells in Packs



IV. Impact of a Cartel on Cylindrical LIB Prices Across the Class

53. Because all or almost all of these cells and packs are substitutes on either the supply side or the demand side or both, prices inevitably are held together by market forces which shift demand toward the products with abnormally low prices and away from products with abnormally high prices, and shift supply in the opposite direction. Both these shifts work to keep prices of different batteries reasonably aligned, lowering abnormally high prices and increasing abnormally low prices, more so over longer periods of time which allow greater battery substitutability on both the demand side and the supply side.

54. For these forces to keep prices aligned it is not necessary that each and every battery be a substitute for all other batteries on the demand side or the supply side. One mechanism that leads to these effects is a chain of substitution effects, the repeated links of which connect all the different products. Think of a row of restaurants lined up on a long street. When the price is cut at the first restaurant in the line, that may shift demand away from the second restaurant, which might respond with a price cut of its own, an affect which would be

passed on down the line all the way to the end, even if the first and last restaurants in the chain are miles apart, and do not share any potential customers.

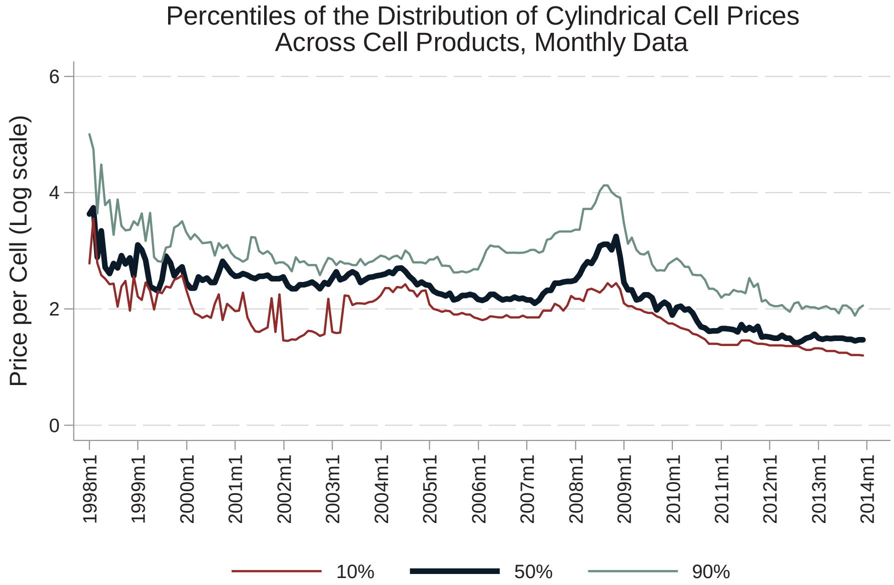
55. A second mechanism that helps to coordinate prices of different batteries is the manner in which manufacturers consciously or unconsciously structure prices by utilizing price-adjustment formulas, rules of thumb, and simplified price setting and adjustment mechanisms. These can spread a conspiracy effect widely across products.

56. A third mechanism that helps to coordinate prices is the sharing of price information and pricing plans. Information about current pricing can come by observing posted prices, by discussing prices with other sellers, and by subscribing to trade journals that gather pricing information.

57. Figure 23 and Figure 24 below confirm the fact that prices of cells tend to move together over time as do prices of cells in packs. The prices used to create these figures are quantity-weighted monthly averages of the prices of products distinguished by: manufacturer, cell or pack, dimension, number of cells in the pack, and capacity.

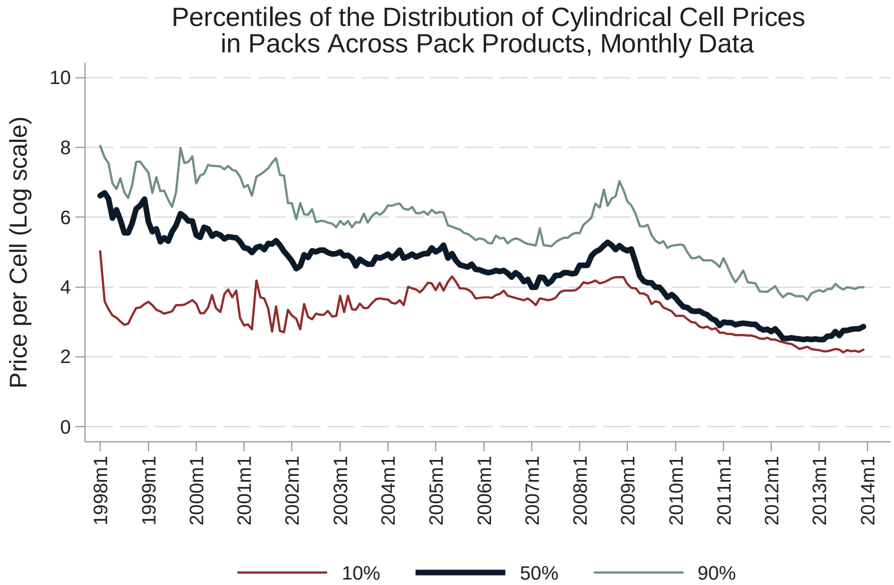
58. Each figure displays the median price, the 10th percentile of prices and the 90th percentiles of these products. These figures reveal the common movement up and down of the 10th percentile, the median and the 90th percentile of the distribution of prices, as if over time the whole range is moving up and down, with individual product prices completely synced.

Figure 23



Source: Defendant Transactional Sales Data.

Figure 24



Source: Defendant Transactional Sales Data.

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59. What stands out in these figures is the price hump in 2008 coincident with the rise in cobalt prices. If this reflects the added costs of making cells or packs, the price hikes in the figure are merely the market reaction to an increase in costs and not evidence of coordination of prices either from normal substitutability or from a broad price-fixing conspiracy. The next step in the analysis is to construct a regression analysis which controls for the cobalt price and other common drivers on the supply side and demand side, thus asking if these price movements are more coordinated than can be explained by common determinants, and thus symptomatic of broad conspiracy effects, either because the conspiracy targets were broad or because the conspiracy impacts were spread to all or almost all of these products by substitution effects.

60. The dependent variable in this regression is the rate of increase in the price of a cell (or pack per cell) and the first two explanatory variables are the rate of growth of a composite of other prices and also the lagged ratio of the price of the composite divided by the price of the cell or pack that is the dependent variable. Unlike the displays above which combine more than one part number into an aggregate this regression analysis uses data on each part number separately. Using these data, I estimate four different types of regressions: two choices for the dependent variable (product-specific cell prices or product-specific pack per cell prices) and two choices for the composite (cell prices excluding the cell which is the dependent variable or pack prices excluding the pack which is the dependent variable). This allows me to study both the linkages within cells or within packs as well as the linkages between cells and packs.

61. If there are common external forces affecting sales of all batteries these common external effects would create common movement in prices even if the products are not substitutes. In the restaurant example, changes in the price of meat might have similar effects up and down the line of restaurants, and the common movement in prices is not necessarily a symptom of substitution on the supply or demand side. For this reason, the regression equation includes the price of cobalt and several economic variables which would tend to move the prices in similar direction, leaving the (partial) correlations among all the

products as measured by the coefficient on the first explanatory variable more likely due to the forces of substitutability on the demand side or the supply side than to common external effects. The other variable is the ratio of the lagged composite price to the product-specific price in the previous period. The hypothesis here is that if this ratio becomes abnormally high it would lead to a correction taking the form of product-specific price increases because of demand side shifts in favor of the specific product or supply shifts toward the high-price composite, in other words a positive coefficient on this variable. The ratio form holds fixed the common component of variability and focuses the estimated effect on the substitution issue.

62. I conduct this analysis using a dataset of monthly weighted average prices of individual manufacturer cell codes. Figure 25 shows an example of one regression for Samsung's ICR18650-22 cell with 2200mAh capacity. The dependent variable, DLog(Cell Price), is the weighted average monthly price of this model code where the averaging is made necessary when the same product is shipped with different prices in the same month. The variable that measures the contemporaneous effect of aggregate prices is the growth rate of weighted average monthly price of all individually sold cells excluding ICR18650-22. The "lagged effect" variable is the lagged weighted average monthly price of all individually sold cells excluding ICR18650-22 divided by the lagged monthly average price of ICR18650-22. This explanatory variable is in a logarithmic form. The external factors are captured by non-overlapping 3 month and lagged 3 month growth rates of cobalt prices, as well as 3 month growth rates of portable PC PPI, housing starts, and industrial production. This regression is weighted by cells quantity sold.

63. This regression confirms the hypothesis of price-coordination in two ways. The estimated positive contemporaneous coefficient signifies that prices move together after controlling for the market effects of cobalt prices, portable PC prices, housing starts, and industrial production. The positive lagged effect also suggests the existence of a "correction" effect controlling for common market drivers via the ratio form. This effect means that abnormally high prices of other cells compared with Samsung's ICR18650-22 cell would tend to produce

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higher rates of growth of the price of Samsung's ICR18650-22 cell in the next month, thus bringing the ratio back toward its historical level.

64. Similarly, Figure 26 shows an example of a regression for LGC packs containing 018650R cells. The contemporaneous effect is measured by the weighted average per-cell monthly prices of all packs excluding LGC 018650R and the lagged effect by the lagged ratio between those two pack price series. The contemporaneous coefficient is positive, suggesting a substitution effect occurring contemporaneously. Here the lagged effect is negative, but with a large standard error.

65. Finally, Figure 27 and Figure 28 show examples of regressions analyzing price effects from packs to cells and from cells to packs. The regression in Figure 27 uses the price of Samsung ICR18650-22 cells for the dependent variable and estimates the contemporaneous and lagged effects using weighted average monthly per-cell prices of all packs on the right-hand side. The regression in Figure 28 uses the price of the LGC 018650R pack for the dependent variable and estimates the contemporaneous and lagged effects using weighted average monthly prices of all cells on the right-hand side. In both examples, contemporaneous and lagged effects are positive showing the existence of substitution effects across cells and packs of the kinds at issue.

66. The magnitude of price coordination effects arising from the contemporaneous and lagged correction forces may vary across products. In the examples below, the estimated contemporaneous effects are substantially larger than the lagged effect. In other instances, a small or no immediate effect may be compensated by a large lagged correction effect or the effect may entirely come from contemporaneous forces, such as in the case of Figure 26. For purposes of exposition, these are combined by adding them together into a total effect.

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Figure 25: Within Cell Price Relationship Example

Common Impact Regression Model
Samsung ICR18650-22 Cells vs All Other Cells

Variable	Estimates	St. Error	T-Stat	P-Value
(1)	(2)	(3)	(4)	(5)
Dependent Variable				
*DLog(**Cell** Price ICR18650-22)*				
Contemporaneous Effect				
DLog(All Other **Cell** Price Average)	0.3548 ***	0.0762	4.6568	0.0000
Lagged Effect				
Log(All Other **Cell** Price Average(-1) / (**Cell** Price Panasonic ICR18650-22))(-1))	0.0551 **	0.0252	2.1888	0.0304
External Factor Variables				
DLog(Cobalt Price)(0-3 month)	0.0221	0.0138	1.5985	0.1123
DLog(Cobalt Price)(3-6 month)	0.0368 ***	0.0131	2.8026	0.0058
DLog(Portable PC PPI)(3 month)	-0.0517	0.0681	-0.7594	0.4490
DLog(Housing Starts)(3 month)	0.0645 ***	0.0206	3.1308	0.0021
DLog(Industrial Production)(3 month)	-0.3731 **	0.1538	-2.4264	0.0166
Constant	-0.0154 **	0.0066	-2.3404	0.0208
Quantity Weights	YES			
R-square	0.2780			
Observations	141			

*** Statistically Significant at 99%; ** Statistically Significant at 95%; *Statistically Significant at 90%.

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Figure 26: Within Pack Price Relationship Example

Common Impact Regression Model
Packs with LGC 018650R Cell vs All Other Packs

Variable	Estimates	St. Error	T-Stat	P-Value
(1)	(2)	(3)	(4)	(5)
Dependent Variable				
*DLog(**Pack** Price LGC 018650R)*				
Contemporaneous Effect				
DLog(All Other **Pack** Price Average)	0.2010	0.1614	1.2455	0.2170
Lagged Effect				
Log(All Other **Pack** Price Average(-1) / (**Pack** Price LGC 018650R))(-1))	-0.0759	0.0686	-1.1053	0.2728
External Factor Variables				
DLog(Cobalt Price)(0-3 month)	0.0306	0.0238	1.2890	0.2016
DLog(Cobalt Price)(3-6 month)	-0.0260	0.0232	-1.1222	0.2655
DLog(Portable PC PPI)(3 month)	0.0278	0.1133	0.2452	0.8070
DLog(Housing Starts)(3 month)	0.0527 *	0.0307	1.7180	0.0902
DLog(Industrial Production)(3 month)	0.2258	0.2550	0.8856	0.3788
Constant	0.0040	0.0133	0.3025	0.7632
Quantity Weights	YES			
R-square	0.1579			
Observations	79			

*** Statistically Significant at 99%; ** Statistically Significant at 95%; *Statistically Significant at 90%.

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Figure 27: Example Price Relationship of Cells and Packs

Common Impact Regression Model
Samsung ICR18650-22 Cell vs All Packs

Variable	Estimates		St. Error	T-Stat	P-Value
(1)	(2)		(3)	(4)	(5)
Dependent Variable					
*DLog(**Cell** Price of ICR18650-22)*					
Contemporaneous Effect					
DLog(**Pack** Price Average)	0.2403	**	0.1068	2.2504	0.0261
Lagged Effect					
Log(**Pack** Price Average(-1) / (**Cell** Price ICR18650-22))(-1))	0.0456		0.0353	1.2931	0.1982
External Factor Variables					
DLog(Cobalt Price)(0-3 month)	0.0231		0.0147	1.5770	0.1172
DLog(Cobalt Price)(3-6 month)	0.0399	***	0.0147	2.7231	0.0073
DLog(Portable PC PPI)(3 month)	-0.0725		0.0717	-1.0102	0.3142
DLog(Housing Starts)(3 month)	0.0586	***	0.0221	2.6554	0.0089
DLog(Industrial Production)(3 month)	-0.3813	**	0.1731	-2.2027	0.0293
Constant	-0.0413		0.0270	-1.5280	0.1289
Quantity Weights	YES				
R-square	0.1715				
Observations	141				

*** Statistically Significant at 99%; ** Statistically Significant at 95%; *Statistically Significant at 90%.

Figure 28: Example Price Relationship of Packs and Cells

Common Impact Regression Model
Packs with LGC 018650R Cell vs All Cells

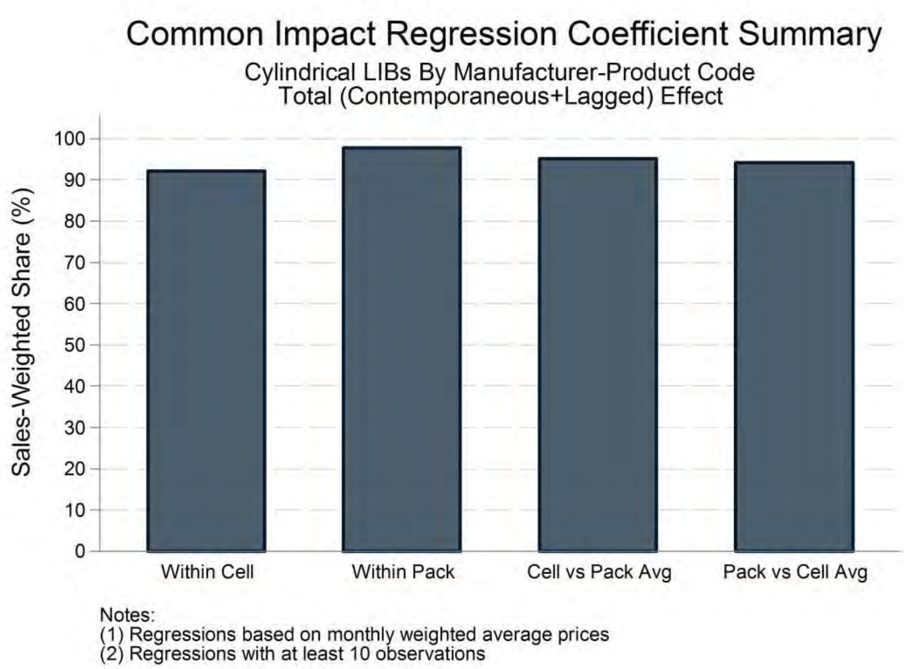
Variable	Estimates	St. Error	T-Stat	P-Value
(1)	(2)	(3)	(4)	(5)
Dependent Variable				
*DLog(**Pack** Price LGC 018650R)*				
Contemporaneous Effect				
DLog(**Cell** Price Average)	0.4392 ***	0.0996	4.4076	0.0000
Lagged Effect				
Log(**Cell** Price Average(-1) / (**Pack** Price Panasonic LGC 018650R))(-1))	0.1238	0.0821	1.5087	0.1358
External Factor Variables				
DLog(Cobalt Price)(0-3 month)	0.0193	0.0226	0.8542	0.3958
DLog(Cobalt Price)(3-6 month)	-0.0100	0.0185	-0.5378	0.5924
DLog(Portable PC PPI)(3 month)	0.0207	0.1017	0.2036	0.8392
DLog(Housing Starts)(3 month)	0.0365	0.0286	1.2754	0.2063
DLog(Industrial Production)(3 month)	0.0331	0.2146	0.1540	0.8780
Constant	0.0496	0.0380	1.3036	0.1966
Quantity Weights	YES			
R-square	0.3067			
Observations	79			

*** Statistically Significant at 99%; ** Statistically Significant at 95%; *Statistically Significant at 90%.

67. I perform these regressions for each individual manufacturer cell part number (or product code) in the dataset, performing in total around 680 separate regressions. The hypothesis that price movements are more coordinated than can be explained by the included market and cost variables requires a positive estimate for the sum of the contemporaneous and lagged effects (the total effect). I summarize the estimates of the total effects in Figure 29 below which illustrates sales-weighted shares of positive total effects for each type of

regression, with the cases with fewer than 10 observations omitted. Performing this many regressions with highly disaggregated individual cell code prices, which are subject to considerable amount of noise, I would not expect every single one to accurately uncover coordinated prices. However, the picture below shows that the overwhelming majority of estimates support the existence of price coordination within cells, within packs, from cells to packs, and from packs to cells. This is strong evidence that all or almost all cells and packs would likely have been impacted by the alleged conspiracy.

Figure 29: Share of Positive Estimated Total Coordination Effects



68. I use the same regression structure to analyze the co-movements of prices paid by different customers. Here, the dependent variable is the growth of the weighted average monthly price paid by one customer. These prices are explained by 1) the growth of weighted average price for all other customers (i.e. contemporaneous effect); 2) the lagged ratio of weighted average price paid by all other customers and the customer at issues (i.e. the lagged effect); 3) macro-economic factors; 3) fixed effects for capacity, dimension, and number of cells (for packs). As before, I estimate four types of regression equations

that analyze price relationships within cells, within packs, and across cells and packs.

69. Figure 30 and Figure 31 are two examples. Figure 30 shows the estimated regression that describes the relationship between prices paid by SIMPLO Technology (an LIB battery packer, which was the largest purchaser of cells in the data) and prices paid by all other customers of cells destined for packing. Figure 31 shows the estimated relationship between pack prices paid by Dell (the largest purchaser of packs in the data) and all other purchasers of packs. In addition, I estimate the cross-price effects of cells on packs and packs on cells. The other regression results are not shown for brevity but available in the backup materials to this report.

Figure 30: Example of Customer Price Relationships Within Cell Products

Common Impact Regression Model
SIMPLO TECHNOLOGY vs All Other LIB Purchasers

Variable	Estimates	St. Error	T-Stat	P-Value
(1)	(2)	(3)	(4)	(5)
Dependent Variable				
*DLog(**Cell** Price SIMPLO TECHNOLOGY)*				
Contemporaneous Effect				
DLog(**Cell** Price All Other Purchasers)	0.2506 ***	0.0410	6.1191	0.0000
Lagged Effect				
Log(**Cell** Price All Other Purchasers(-1) / (**Cell** Price SIMPLO TECHNOLOGY))(-1))	0.0528 ***	0.0114	4.6307	0.0000
External Factor Variables				
DLog(Cobalt Price)(0-3 month)	0.0017	0.0074	0.2280	0.8197
DLog(Cobalt Price)(3-6 month)	0.0370 ***	0.0071	5.2259	0.0000
DLog(Portable PC PPI)(3 month)	-0.1518 ***	0.0368	-4.1274	0.0000
DLog(Housing Starts)(3 month)	-0.0281 **	0.0112	-2.5135	0.0122
DLog(Industrial Production)(3 month)	-0.0411	0.0868	-0.4735	0.6360
Constant	-0.0098	0.9193	-0.0107	0.9915
Capacity Indiciators	YES			
Quantity Weights	YES			
R-square	0.1590			
Observations	693			

*** Statistically Significant at 99%; ** Statistically Significant at 95%; *Statistically Significant at 90%.

Note: (1) Simplo insample purchases conatined only 18650, hence no dimension indicators estimated.

Figure 31: Example of Customer Price Relationships Within Pack Products

Common Impact Regression Model
DELL vs All Other LIB Purchasers

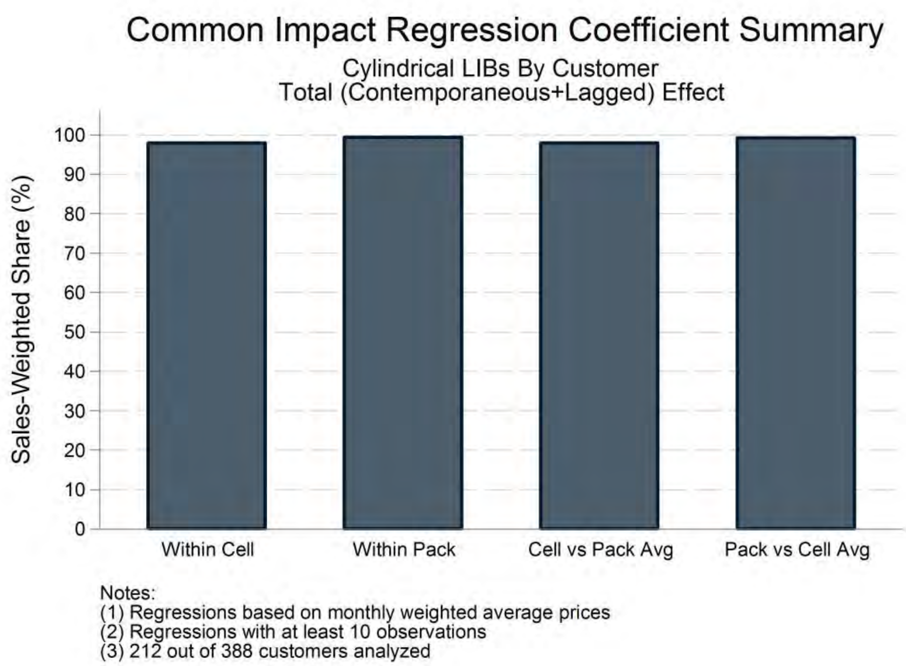
Variable	Estimates	St. Error	T-Stat	P-Value
(1)	(2)	(3)	(4)	(5)
Dependent Variable				
*DLog(**Pack** Price DELL)*				
Contemporaneous Effect				
DLog(**Pack** Price All Other Purchasers)	0.3386 ***	0.0264	12.8438	0.0000
Lagged Effect				
Log(**Pack** Price All Other Purchasers(-1) / (**Pack** Price DELL))(-1))	0.1080 ***	0.0078	13.8392	0.0000
External Factor Variables				
DLog(Cobalt Price)(0-3 month)	0.0100 **	0.0040	2.5039	0.0123
DLog(Cobalt Price)(3-6 month)	0.0178 ***	0.0037	4.7759	0.0000
DLog(Portable PC PPI)(3 month)	-0.0047	0.0181	-0.2568	0.7974
DLog(Housing Starts)(3 month)	-0.0013	0.0069	-0.1923	0.8476
DLog(Industrial Production)(3 month)	0.0017	0.0525	0.0330	0.9737
Constant	0.1527	0.0944	1.6164	0.1061
Capacity Indicators	YES			
Dimension Indicators	YES			
Number of Cells Indicators	YES			
Quantity Weights	YES			
R-square	0.1557			
Observations	2,500			

*** Statistically Significant at 99%; ** Statistically Significant at 95%; *Statistically Significant at 90%.

70. These regressions allow the price of the comparison group to affect the price of the product under study through the contemporaneous effect and through the lagged effect. The sum of these two effects is the total effect. Figure 32 summarizes the total estimated effect in terms of a sales-weighted share of positively estimated coefficients from 474 regressions. The nearly 100 percent share of positive total effects is strong evidence that prices paid by various

customers are tied together beyond the coordinated movement that comes from common market and common cost effects which are controlled for in the regressions.

Figure 32: Share of Positive Estimates in Customer Price Relationships



V. Preliminary Analysis of Cartel Impact and Lithium Ion Batteries Overcharges

A. Nature and Effect of the Alleged Conspiracy

71. The foregoing discussion has made clear that large swings in cobalt prices had significant effects on LIB manufacturing costs. In the face of rising prices of important inputs, producers will try to pass the added cost onto their customers, but the extent of their ability to do so depends on what their competitors are doing. In a competitive environment, if a seller increase prices by too much relative to the cost, competitors are able to profit by selling at lower prices, taking away sales from the firm with the excessive increase. This limits the amount and duration that the market price can overshoot cost increases. But if these businesses are conducting conversations with each other

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about how to handle the increase in costs, these conservations can create implicit promises not to undercut each other's price increases, which facilitates price increases in excess of the increases justified by the cost increases. Thus the use of a input price as a coordinating mechanism in a cartel can change the price response to input price changes and increase the effectiveness of the collusive effort.

72. I understand that Dr. Abrantes-Metz has reviewed evidence of the alleged cartel and concluded it operated effectively throughout the Class Period. I understand also that Dr. Abrantes-Metz describes how cobalt could have served as an effective coordination mechanism. I have also reviewed certain documents relating to the alleged cartel. These documents indicate Defendants colluded with respect to their price response to increases in cobalt prices.

73. The rise in cobalt prices from $10.93 per pound in October 2003 to $27.52 per pound in February 2004 was noticed by LIB manufacturers who discussed the extent to which customers could absorb this increase in cost per Hitachi documents dated 2/18/2004:

> With regards to the price reduction request from the current customers, first of all, I believe that it will be effective to make it a reason during the negotiations to stand firm on the price.
>
> The problem is when we ask for the price increase we may run into problems if competitors aren't doing the same thing. Thus we need to monitor what competitors are doing and proceed.[32]

and

> "The other day we [Hitachi] met with the Sales Division Manager at Sanyo (to negotiate for a decrease with the MH price). At that time there was talk from the other

[32] See HML-P-076854E (2/18/2004 Hitachi-Maxell email).

party about a price increase in LIB due to the increased price of CO [cobalt]."[33]

74. These 2004 documents are suggestive but not decisive with regard to the use of cobalt prices to coordinate price increases, but following the rise in cobalt prices from $14.16 in July 2006 to $30.64 in April 2007, Mr. Tachihara of Sanyo Electric met with competitors to discuss how to deal with the increase in cobalt prices. (Tachihara deposition page 64)

> Q. Was there any particular reason that you got in touch with or were in touch with competitors in April of 2008 – excuse me -- of 2007?
>
> MS. COLE: Object to form.
>
> A. I think the reason was that there was an increase in cobalt prices at the time.
>
> Q. And so Sanyo Electric and its competitors, because of the increase in the price of cobalt, wanted to increase the prices that they charged for battery cells and battery packs, correct?
>
> MS. COLE: Object to form; overbroad.
>
> A. In lithium ion battery, cobalt is one of the component ingredients and the increase of the ingredient price means increase of the lithium ion battery -- battery and in that respect, we needed help from our customers.
>
> Q. Well, you also needed help from your competitors, right, to make sure that the prices went up?

---

[33] See Ex. 715E (2/21/2004 Hitachi-Maxell email). and Ex. 504E (2/25/2004 NEC email discussing need to find out what competitors are doing)

MS. COLE: Object to form.

A. Since it was long time ago, I do not really remember, but I think it started because -- since we were in sales, we wanted to make sure that we do not lose the orders from customers even when we increase prices.

Q. And that was why you were in contact with your competitors, correct?

MS. COLE: Object to form.

A. I do not really recall, but I think that was the reason why we got in contact with competitors.

Q. You wanted to make sure that if Sanyo raised its prices, it wouldn't lose orders because other competitors were charging less, right?

MS. COLE: Object to form.

A. Yes, that's right.

75. The collusion can be more effective if price planning and cost information is shared. The manufacturers did adopt formulaic approaches to using cobalt prices in determining their price increases[34] and they shared information about how each was using cobalt in pricing.[35] I understand the alleged conspirators attempted to keep their formulas secret from their customers[36] (perhaps

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[34] See e.g., Ex. 1148E (4/9/2007) at SANYO-C000087891E (formula description).

[35] See Ex. 617 (3/7/2007 email: Panasonic gathering information from SDI and Sanyo re cobalt in their own negotiations), Ex. 1104E (4/24/2007, Panasonic/Matsushita/Sanyo/Toshiba), Ex. 1109E (6/20/2007), Ex. 1110E (6/21/2007), Ex. 1111E (8/2/2007).

[36] See Ex. 1127 (5/12/2008 "Up to now SEC (TW) has not given out the formula to the customer. Further we are carrying out the price increase from Japan + [alpha]. We are planning to carry out a price increase from July 1, this time also without making a presentation of the formula to the customer."

because the of the disparity in cost and price increases) while sharing their own expectations for cobalt prices.[37] A formula is explicitly discussed in the deposition of Mr. Tachihara:

> Q. And part of -- and the reason for discussing the price increase among the three companies was to make sure that all three companies did, in fact, raise prices, correct?
>
> MS. COLE: Object to form.
>
> A. How we proceeded at the time was that we had a formula to reflect the price increase of cobalt in the price of cell, and I do not remember about other two companies, but I think at that meeting, I discussed that Sanyo is going to proceed with this formula, and I talked about Sanyo's policy with regard to limited models and limited period of time.
>
> Q. What was the formula that Sanyo was using to reflect the price increase of cobalt in the price of the cell?
>
> MS. COLE: Object to form.
>
> A. There's a certain market price of cobalt, and the formula showed how it's reflected in the price of a cell, and depending on the portion of price increase of cobalt, we asked for help and that happens when the cobalt price increased, and if it decreased, there was a different way that we proceeded with.

[37] LGC-MDL-0000770 at 780 (10/12/2008 LGC and Panasonic exchange cobalt price forecast) and 787 (LGC and Sanyo meet the following day).

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76. Based on this deposition, I will include in my overcharge model the possibility that the conspiracy might have increased the sensitivity of battery prices to cobalt prices commencing in April 2007. This detail of the model is subject to revision if and when additional information is received.

B. Analysis of Lithium Ion Batteries Overcharges

77. A method of examining the effect of a price-fixing conspiracy widely recognized in the economic literature,[38] is to compare prices during the period in which the conspiracy operated to prices before and/or after it operated.[39] There are various ways of implementing such an analysis. Depending on the context, a simple comparison of price levels during the conspiracy period with levels in which the conspiracy did not operate may suffice. This is the case when there aren't very many meaningful changes in the market or product quality. In most cases, however, we expect that product quality and market factors in addition to the conspiracy may impact prices during the period in question. Therefore, more sophisticated methods are used to isolate the effects of the conspiracy.

78. One such method widely employed by economists,[40] referred to as "reduced form" regression analysis, is to estimate a model of price formation that includes product attributes and market demand and supply variables and

[38] For a review of well-established methods of economic analysis used to estimate damages in price-fixing litigation see: J. M. Connor, "Forensic Economics: An Introduction With Special Emphasis On Price Fixing," *Journal of Competition Law and Economics* 4.1 (2007): 31-59 and P. Davis and E. Garcés, *Quantitative techniques for competition and antitrust analysis* (Princeton: Princeton University Press, 2010): 347-381. See also D. L. Rubinfeld, "Antitrust Damages," *Research Handbook on the Economics of Antitrust Law*, Einer Elhauge editor, November 21, 2009.

[39] In some cases, data may not be available for periods of time either before or after the alleged conspiracy that are completely free from its effects. However, the available data may allow one to compare periods in which the alleged conspiracy was fully effective with periods in which it was only partially so, in which case one can estimate a lower bound on the overcharges created by the alleged conspiracy.

[40] See e.g., J. F. Nieberding, "Estimating Overcharges In Antitrust Cases Using A Reduced-Form Approach: Methods and Issues," *Journal of Applied Economics*, IX- 2 (Nov 2006): 361-380; Hayley Chouinard, and Jeffery M. Perloff, "Gasoline Price Differences: Taxes, Pollution Regulation, Mergers, Market Power, and Market Conditions," CUDARE Working Papers, University of California, Berkeley.(2002): 1-32.

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variables reflecting the presence of the conspiracy. Essentially, this kind of regression analysis provides an estimate of the impact of the alleged conspiracy on prices, holding constant the effects of other supply/demand factors in the model.

79. I demonstrate here feasible methodologies to estimate overcharges on cylindrical LIBs. I have assumed for purposes of this exercise that the conspiracy operated beginning no later than 2000 until about April 2011. However, the "dynamic" regression model that I use allows for persistence in the effects of the conspiracy, leaving elevated prices lingering into the post-conspiracy period.

80. The transaction data produced by the Defendants spans the time period from 1997 to 2013. These data reflect global LIB sales by seven of the Defendants: Hitachi-Maxell, LG-Chem, Panasonic, Samsung SDI, Sanyo and Sony. The prices that I used in this analysis are monthly average prices, created from the transactional data. Each observation in the monthly dataset is the quantity-weighted average price per cell for each product defined by manufacturer × dimension × cell capacity × cell or pack × number of cells in the pack for packs.[41] I have treated the periods before January 2000 and after April 2011 (i.e., 1997 – 1999 and May 2011 – 2013) as non-conspiracy periods. To the extent there were cartel activities that elevated prices prior to January 2000, I would expect this to cause my estimates to understate the magnitude of the cartel's impact during the Class Period.

81. The framework for estimation I propose allows for persistence in LIB prices, which is to say a current month's prices are determined in part by that month's economic conditions, but also by what the price was in the prior month.[42] A

[41] This monthly average price per cell is found by dividing total revenue by total quantity of cells shipments for a particular model-manufacturer combination. For packs, the quantity of cells is computed by multiplying pack transaction quantity with number of cells in the pack.

[42] The inclusion of lagged prices implies that in calculating overcharges from the estimated coefficients, I have to account for the effect of the alleged conspiracy on the lagged prices in addition to its immediate effect. See e.g., James F. Nieberding, "Estimating Overcharges In Antitrust Cases Using A Reduced-Form Approach: Methods and Issues," *Journal of Applied Economics* IX-2 (Nov 2006): 361-380.

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generic dynamic model of price formation takes the form of an equation that explains the price at time t, p(t), as a function of the price in the previous period p(t-1), a contemporaneous determinant of prices x(t), a lagged effect x(t-1) and a collection of other effects summarized by a random unobservable variable ε(t)

$$p(t) = \alpha+\beta\, p(t-1) + \theta_1\, x(t) + \theta_2\, x(t-1) + \varepsilon(t)$$

82. A permanent increase in the variable x(t) by one unit per this model increases the price in the first period p(t) by the amount θ_1. In the subsequent period the price increment becomes $\theta_1 + \beta\, \theta_1 + \theta_2$ allowing for the effect of the lagged dependent variable and the lagged value of x. This price continues to elevate converging to a new equilibrium equal to $(\theta_1+ \theta_2)/ (1- \beta)$.

83. The model that is used here to study the cartel impact uses a binary indicator D(t) (dummy variable) turned on from January 2000 to April 2011. This indicator is allowed to alter the constant in the equation, which, per the discussion in the previous paragraph, produces a cartel effect which grows gradually over time.

$$p(t) = \alpha + \delta D(t)+\beta\, p(t-1) + \theta_1\, x(t) + \theta_2\, x(t-1) + \varepsilon(t)$$

84. There are two salient features of the price data for both cells and cells in packs which need to be captured by a credible model: (1) a substantial downward trend in prices and (2) a price hump in 2008 and 2009 in the midst of a very serious global economic downturn that weakened demand for almost all products and eliminated pricing power of many business entities. Evidence of the weakness of demand overall is the highly abnormal decline in the U.S. Producer Price index after the Lehman bankruptcy in September of 2008 illustrated below. Also displayed below is the Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers. Price declines in this sector continued unabated during the Great Recession. Both these charts suggest that LIB battery prices should be declining in 2008 and 2009, because of the collapse in demand and because of the underlying technological trends. The actual increase in 2008 and 2009 is thus suspicious.

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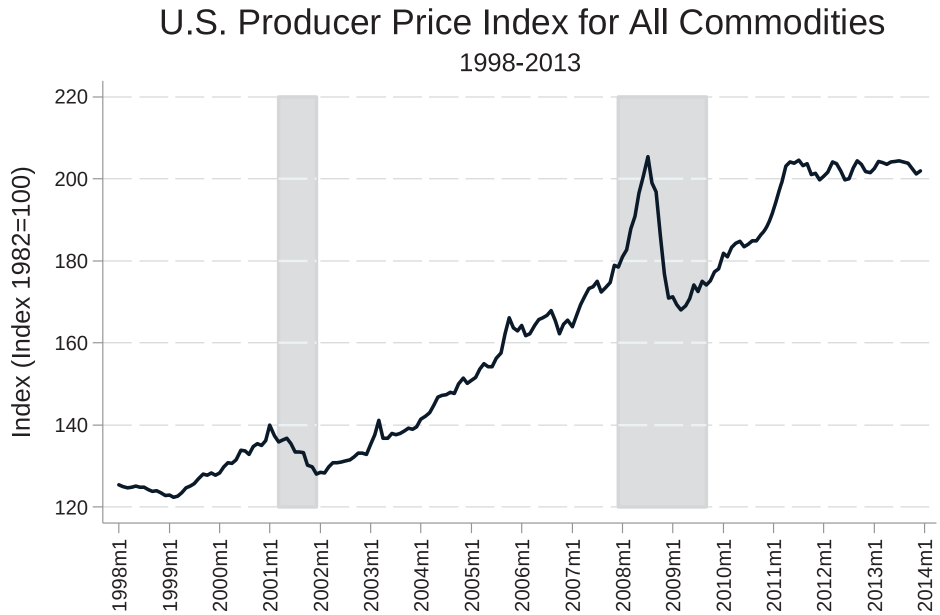
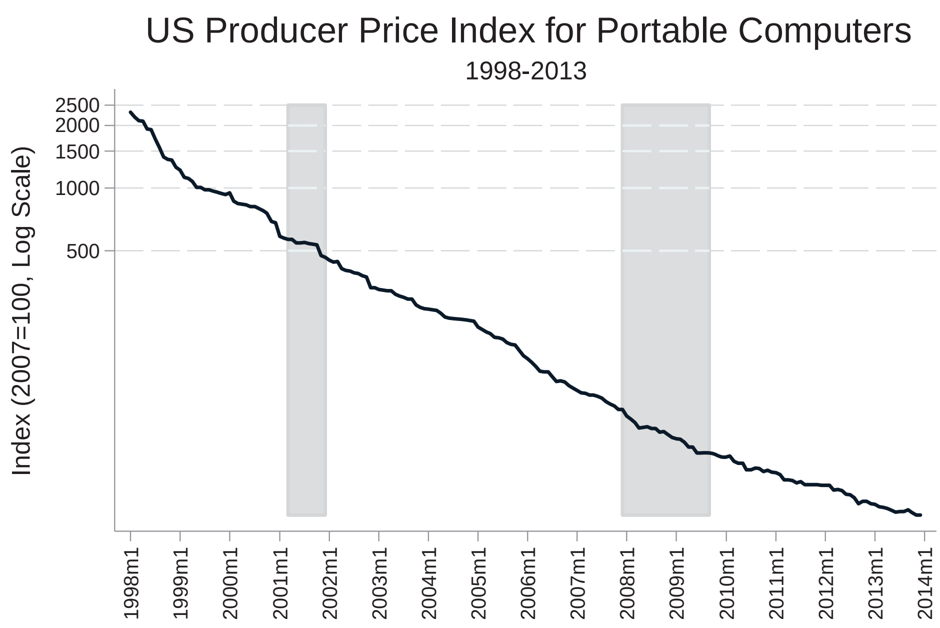
Figure 33



Source: Bureau of Labor Statistics



Source: Bureau of Labor Statistics

85. The model that I present captures the long term downward trend of battery prices with the producer price index for portable computers. The logic for this choice is that this portable computer price index declines at a rate that is symptomatic of the technological improvements in consumer electronics generally. This is not meant to suggest that changes in portable computer prices cause changes in battery prices. There is also no assumption that there is a one-for-one relationship between the price trend for batteries and the price trend for portable computers. The data will tell us the relationship, if any.

86. The other salient features in the battery prices are price humps in 2004 and 2009 which follow humps in cobalt prices by about 6 months. The model that I use ideally would include costs of all types but such data are unavailable. I use the cobalt price lagged three months and lagged six months in an attempt to explain the price humps. As described above I also explore the possibility that the conspiracy operated more effectively between April 2007 and December 2009, a period starting with the Defendants apparent agreement to communicate about how cost would affect their pricing and ending when I understand cartel communications may have diminished.

87. I estimate the overcharges for the Class Period for both cylindrical cells and cylindrical cells in packs using monthly data from January 1997 to December 2013. The conspiracy operates through the elevated constant applicable to the period January 2000 through April 2011 and also through variables that capture how the pricing relationship of cylindrical LIB prices to cobalt price changed during the period in which the members of the cartel were communicating about it.

88. A second indicator applicable to the period April 2007 through December 2009 interacted with cobalt prices can capture changed responsiveness to cobalt prices in this period. With just this additional variable the model would imply a discrete jump at the beginning of that period and at the end (jumps which are not in the data). Thus for such a model to track the data well, it also needs a binary indicator for this April 2007 to 2009 period, which I include in the model. The results of estimating this model are reported in Figure 34.

89. The model includes the price of the battery lagged one month as an explanatory variable, the cobalt price lagged three months and six months as suggested by the images above, the producer price of portable PCs to capture the typical pace of technological improvement in the industry, and the "macro-economic" variables, housing starts and industrial production, which capture the Great Recession and other swings in aggregate demand. All variables are in logarithmic form.

90. The model contains three variables that combine to determine the total estimated conspiracy effect. The overcharge percentages and amounts per cell implied by this model are found by "turning off" these variables that measure the cartel impact. The combined effect is positive during the Class Period for both cylindrical LIB cells and cylindrical LIB cells sold in packs. When this is done the average overcharge percentages per cell are 18.6 percent (for cylindrical LIB cells), and 13.9 percent (for cells in cylindrical LIB packs).

91. Figure 35 and Figure 36 display the weighted average actual prices and the prices but-for the conspiracy for cylindrical LIB cells and cylindrical LIB cells that were sole in packs (respectively).

Figure 34: Estimated Models of Cartel Overcharges on Cylindrical LIB

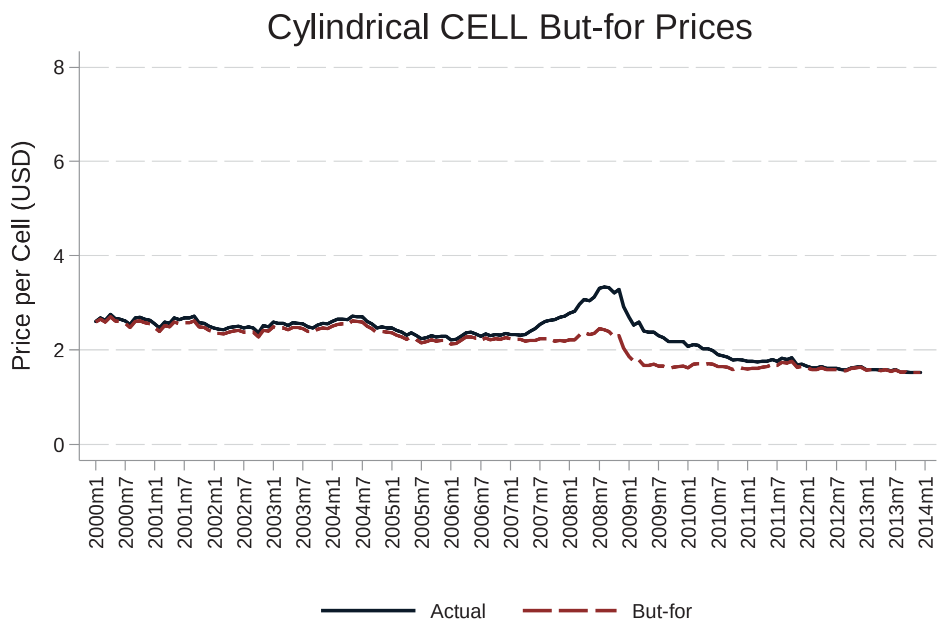
Variable	Cells: Coefficient	Cells: T-Stat	Cells in Packs: Coefficient	Cells in Packs: T-Stat
(1)	(2)	(3)	(4)	(5)
Dependent Variable				
Log Price Per Cell [1]				
Conspiracy Indicator (Jan 2000-April 2011) [2]	0.004 *	1.70	0.005 ***	3.52
Alt. Cobalt Sensitivity Period (April 2007-Dec 2009) [3]	-0.045 ***	-2.69	-0.050 ***	-4.69
Log Price Per Cell (-1)	0.893 ***	150.50	0.879 ***	236.95
Log Cobalt Price (-3) [4]	0.043 ***	10.65	0.022 ***	8.83
Log Cobalt Price (-6)	-0.037 ***	-8.22	-0.008 ***	-2.79
Log Cobalt Price (-6) x (April 2007-Dec 2009)	0.023 ***	4.07	0.023 ***	6.53
Log Portable PC PPI [5]	0.033 ***	10.42	0.028 ***	13.50
Log Housing Starts (-1) [6]	0.021 ***	3.10	-0.003	-0.57
Log Housing Starts (-3)	-0.032 ***	-4.54	0.003	0.59
Log Industrial Production Index (-1) [7]	-0.039	-0.55	0.206 ***	4.52
Log Industrial Production Index (-3)	0.156 **	2.17	-0.245 ***	-5.41
Constant	-0.554 ***	-4.14	0.164 *	1.88
Fixed Effects	YES		YES	
Quantity Weights	YES		YES	
Observations	5,440		17,647	
R-squared	0.979		0.979	

*** Significant at 1% level; ** Significant at 5% level; * Significant at 10% level

[1] Monthly average price per cell weighted by quantity of cells for each manufacturer, dimension, capacity, cell or pack and number of cells in pack combination
[2] Conspiracy Indicator takes the value one from January 2000-April 2011
[3] Alternate Cobalt Sensitivity Period takes the value one from April 2007-December 2009
[4] Monthly Cobalt Price /lb
[5] Producer Price Index for Portable Computers, Laptops, PDAs and Other Single User Computers
[6] U.S. Annual Rate for Housing Units Starts
[7] U.S. Industrial Production Index

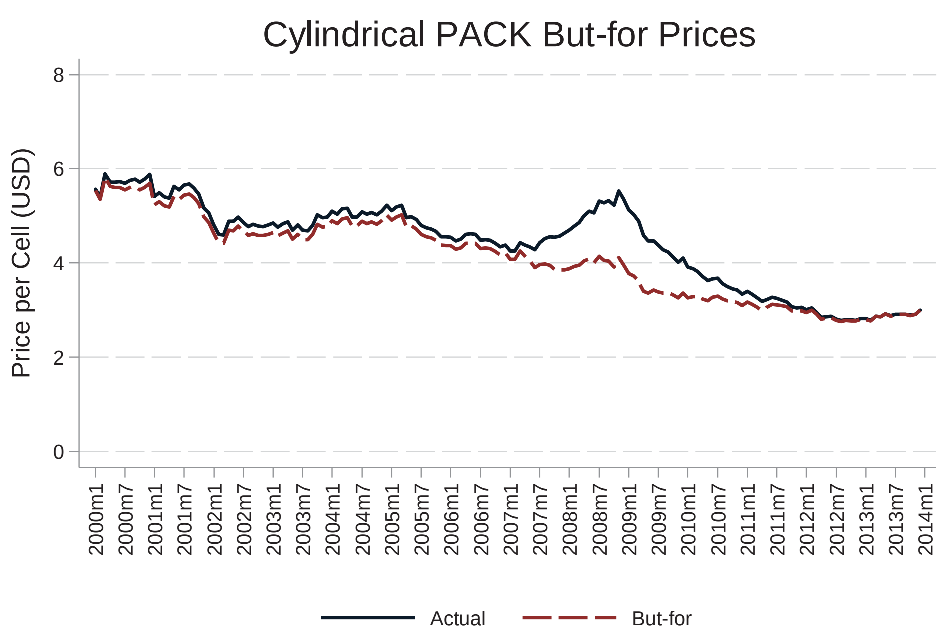
Source: Defendants' Transactional Sales Data, London Metal Exchange, Federal Reserve, Bureau of Labor Statistics, US Census

Figure 35: Actual and But-For LIB Cell Prices



Source: Defendant Transactional Sales Data and Overcharge Regression Results

Figure 36: Actual and But-For Prices Cells in Packs



Source: Defendant Transactional Sales Data and Overcharge Regression Results

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VI. Fabrication of Cylindrical LIB Products and their Distribution to End-Users

A. LIB Distribution Chain

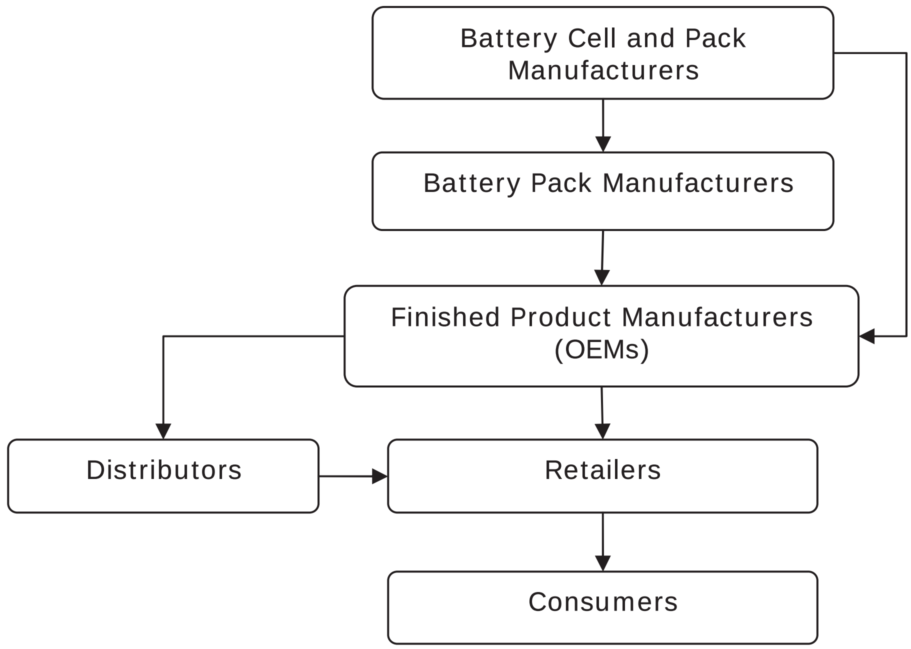
92. Cylindrical LIBs reach consumers in the U.S. and the world through a distribution chain much like other consumer products. As described above, LIB cell manufacturers sometimes sell cylindrical LIBs as cells and sometimes sell them after fabricating them into packs. Firms that purchase LIB cells and fabricate and sell LIB packs are called "packers." Packers include firms such as Simplo and Dynapack.[43] Cylindrical LIB battery packs (and sometimes the cells) are purchased by electronics manufacturers to be fabricated into consumer electronics. The major types of products that use these LIB batteries include notebook PCs, camcorders, and power tools. The manufacturers that purchase LIBs may include branded manufacturers such as Dell and Black & Decker. Other purchasers may be contract manufacturers such as Wistron and Foxconn who put another company's brand on the product.[44] Consumers typically purchase products from retailers such as BestBuy, Walmart, or Amazon, but some products go through distributors such as Ma Labs and Evertek before reaching retailers, while other manufacturers, such as Dell, sell directly to consumers.[45]

[43] See LGC-MDL0098436 at 446.

[44] "Wistron lands Sony's orders for notebook PCs," EMSNow, May 25, 2007; "Dell Computer Corporation," Encyclopedia.com, http://www.encyclopedia.com/topic/Dell_Computer_Corp.aspx.

[45] "About Us.", Ma Labs, http://www.malabs.com/company/aboutus.php. See, also, "About Evertek.", Evertek, https://www.evertek.com/about/about_evertek.asp.

Figure 37: Lithium-Ion Battery Distribution Chain



B. Cylindrical LIB in End-Use Applications

93. Notebook PCs accounted for approximately 75 percent of cylindrical LIB use with the remainder divided mainly among camcorders, and power tools. Although during the entire relevant period notebooks were always the major application, usage of cylindrical LIBs grew substantially across these other applications.

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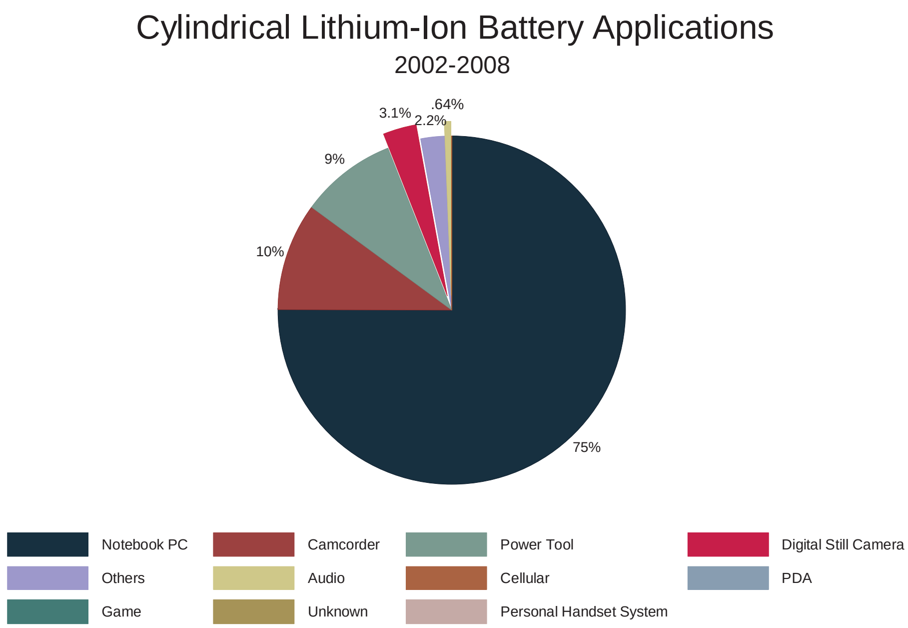
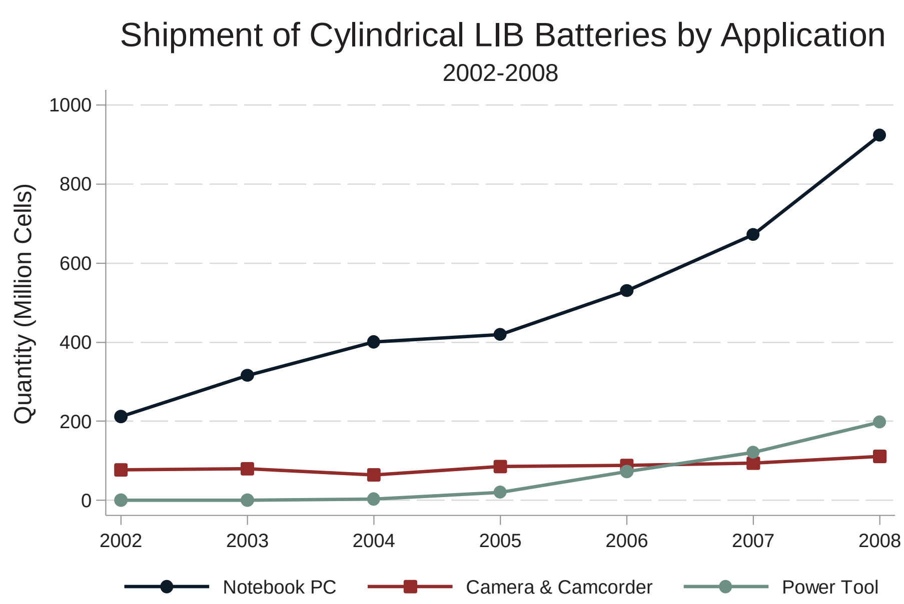
Figure 38: Cylindrical LIB Applications



Source: IIT LIMX Data (PANA-C000076205.xls).

Figure 39



Source: IIT LIMX Data (PANA-C000076205.xls)

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94. By 2000, more the three-quarters of rechargeable battery cells used in notebook PCs were cylindrical LIBs and by 2003 the use of cylindrical LIB cells in notebook PCs had grown to about 95 percent.[46]

95. Almost all notebook computers produced and sold during the class period used cylindrical LIB cells. Between 2002 and 2008, 94 percent of notebook computers used cylindrical LIB cells. The cost share of the battery in a notebook PC is generally reported to be about 6 percent.[47] The exceptions (e.g., the Macbook Air) are readily identifiable through identifiers on the product and product specification sheets.

96. For other product categories, a mix of LIB, LIB types, or LIB and other battery technologies were used. However, each individual model, and often substantial segments of the product categories used a single battery type. For example, for power tools that used LIB between 2002 and 2008, it is reported that almost all sales were of products using cylindrical cells. Lithium ion batteries quickly replaced NiCd and NiMH in camcorders early in the decade; by 2003 more than 90 percent of cells used in camcorders were cylindrical LIB cells.[48]

VII. The Impact of the Conspiracy on IPP Class Members

97. Above I have shown that the impact of the cartel was to raise price to direct customers; that is, direct customers were harmed by the cartel by facing higher prices for LIBs. In order for class members to have been harmed by the cartel, at least some portion of the overcharge imposed on direct purchasers must have been passed down the distribution chain all the way to class members.

98. In order to address the extent to which battery overcharges were passed on to class members, I first review the economic theory of pass-through. A wide variety of economic models provide the logic for 100 percent cost pass-

[46] See SONY-LIB-0004764645 at 466-468.

[47] Larry Dignan, "PC bill of materials creep higher amid hard drive shortage," *ZDNet,* Febuary 6, 2012.

[48] See SONY-LIB-0004764645 at 466-468

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through, or for greater or less than 100 percent, but no theory of which I am aware suggests zero or negative pass-through. Next, I present documentary evidence showing that Defendants expected resellers of LIB products to pass through cost changes. These documents also establish that Defendants routinely monitored the markets for LIB products. This monitoring indicates that Defendants were aware of the connection between the price charged to direct purchasers and the amounts paid by class members. Finally, I conduct analyses of the relationship between product costs and the prices paid by customers for a variety of products at different points in the distribution network that were ultimately purchased by class members (including one that specifically examines the relationship between battery costs and finished product costs). I find strong empirical support for the hypothesis that cost increases were passed on to purchasers down the distribution chain and on to end-users.

99. My analysis and review of the literature and documentary evidence leads me to conclude that at least some portion of the cartel overcharge was passed on to class members who were therefore harmed by the cartel.

A. The Economics of Pass-Through

1. Theoretical Frameworks

100. The economics literature on pass-through provides useful frameworks explaining how the fraction of a cost increase that a seller can pass through to his or her customers depends on (1) the extent to which the cost increase is incurred by all of the market participants, or just a few, (2) on supply and demand elasticities and also on (3) the competitive structure of the market, which is determined by the number of buyers and number of sellers, the way information about transactions is acquired, and possibly collusive agreements among the market participants.[49]

[49] See *e.g.*, Robert G. Harris and Lawrence A. Sullivan, "Passing on the Monopoly Overcharge: A Comprehensive Policy Analysis," *University of Pennsylvania Law Review,* 128- 2. (Dec., 1979; George Kosicki and

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101. According to the competitive model of supply and demand, the market price is determined by the marginal supply and demand, and the market price will remain unchanged when the supply and demand curves change in a way that leaves the margins the same. This means that a small cost increase affecting only inframarginal sellers (i.e., those who are not essentially indifferent between purchasing or not at the current price) would leave the market price unchanged. The market price would change if there is an increase in costs of the marginal sellers or if the increase in cost is great enough that some inframarginal sellers drop out of the market. An increase in costs (e.g. price of a part) that affects all competitors to an identical extent would shift the whole supply curve by 100 percent of the cost increase. The higher prices associated with this change in supply tends to reduce the amount sold. For a normal supply curve, this reduction in production comes with lower marginal costs and thus lower prices, which offsets some of the increase in costs on prices. In other words, in the standard supply and demand model, the fraction of the increase in costs which is passed on to market prices is a number between zero and 100 percent depending on the elasticities of supply and demand.

102. The percentage of a cost increase that is passed on to buyers also depends on the competitive structure of the market - *i.e.*, the market power of sellers and buyers. If there is only one seller (a monopolist) in the market, and if the demand curve is linear, theory indicates that the monopolist passes on less than 100 percent of the cost increase (*i.e.*, "undershifting"). However, a monopolist facing a constant elasticity demand curve will pass through more than 100 percent of cost (*i.e.*, "overshifting").[50]

103. Undershifting and overshifting may also occur in markets with a few sellers (*i.e.*, oligopoly and monopolistic competition), with the outcome again depending on

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Miles B. Cahill, "Economics of Cost Pass Through and Damages in Indirect Purchaser Antitrust Cases," *The Antitrust Bulletin*51-3 (Fall 2006); Theon van Dijk and Frank Verboven, "Quantification of Damages," *3 Issues in Competition Law and Policy*, ABA Section of Antitrust Law, (2008) ; and Oxera, *Quantifying Antitrust Damages. Towards Non-binding Guidance for Courts: Study Prepared for the European Commission*, (December 2009): 1-179.

[50] See Ronald Cotterill, Leonard Egan and William Buckhold, "Beyond Illinois Brick: The Law and Economics of Cost Pass-Through in the ADM Price Fixing Case," *Review of Industrial Organization* 18(2001).

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curvature of the demand curve.[51] Some economists have argued that firms in imperfectly competitive industries "undertake nonprice strategies that shape demand curves into distinctly non linear forms to ensure that pass through is 100 percent or greater."[52] Indeed, firms in industries with branded, differentiated products, in particular (as is the case with the computer and consumer electronics industries), may undershift, overshift, or pass through exactly 100 percent of the cost increase.[53]

2. Theory Relevant to the Products at Issue

104. Standard microeconomic theory shows that the only situations in which exactly zero pass-through would be expected in the face of a cost increase are if either a) an entire industry (not individual producers within the market) faced a perfectly elastic (*i.e.*, horizontal) demand curve;[54] or b) the market supply curve

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[51] The key parameter is the price elasticity of demand, the degree to which the price elasticity of demand changes as prices increase. See e.g., Ronald Cotterill, Leonard Egan and William Buckhold, "Beyond Ilinios Brick: The Law and Economics of Cost Pass-Through in the ADM Price Fixing Case," Review of Indusrial Organization 18(2001).
and Theon van Dijk and Frank Verboven, "Quantification of Damages," Issues in Competition Law and Policy (2008).

[52] See Ronald Cotterill, Leonard Egan and William Buckhold, "Beyond Ilinios Brick: The Law and Economics of Cost Pass-Through in the ADM Price Fixing Case," Review of Indusrial Organization 18(2001).

[53] See *e.g.*, Simon P. Anderson, Andre de Palma and Brent Kreider, "Tax incidence in differentiated product oligopoly," *Journal of Public Economics*, 81(2001).; and Theon van Dijk and Frank Verboven, "Quantification of Damages," *Issues in Competition Law and Policy* (2008).

[54] Robert G. Harris and Lawrence Al Sullivan, "Passing on the Monopoly Overcharge: A Comprehensive Policy Analysis," University of Pennsylvania Law Review 128-2(Dec. 1979: 285. In the case of the market-wide horizontal demand curve, it should be noted that "individual firms may face a perfectly elastic demand curve, but, by definition, though, an *industry* does not face a perfectly elastic demand curve, because an industry is defined (over product, geography, and time) in terms of intra-and inter-industry cross-elasticities of demand. In short, a perfectly elastic demand curve for an industry implies that there is a nearly perfect substitute for that industry. A near-perfect substitute, however, means that the cross-elasticity of demand between two products is very high (that is, a price change in one product will raise sales of the other significantly), so that both products ought to be defined as part of the same industry in the first place." Thus, if the industry has been properly defined, the demand curve it faces will not be perfectly elastic. See Robert G. Harris and Lawrence Al Sullivan, "Passing on the Monopoly Overcharge: A Comprehensive Policy Analysis," University of Pennsylvania Law Review 128-2(Dec. 1979: 285-286.

is perfectly inelastic (*i.e.*, vertical) at the margin.[55] The demand curve for LIB batteries which have no viable substitutes in many applications is surely not perfectly elastic. A perfectly inelastic supply curve is also highly unlikely because even with manufacturing capacity constraints output can be increased with multiple shifts and more rapid operations. Therefore, with the zero pass-through scenario a highly unlikely outcome for theoretical reasons, we should be regarding as highly probable that at least a portion of increased LIB costs were passed through to computer and consumer electronic equipment prices. There is consequently some harm to consumers of these products that would be a consequence of a successful collusion that raised LIB prices.

105. Moreover, there are plausible theoretical frameworks applicable in these industries' market structure that suggest we may anticipate overshifting of increased LIB costs. First, according to Fullerton and Metcalf (2002), overshifting may occur whenever any market structure other than idealized perfect competition is considered.[56] Computer and consumer electronics goods makers do not operate in a perfectly competitive market. Producers in this industry sell differentiated products—products that compete directly with those sold by their rivals—but with (at least) slightly different product attributes. Thus, computer and consumer electronics goods makers face at least some small degree of market power. That is, they have some flexibility in setting prices, and can raise prices, though they may lose at least some customers if they do so.

106. Therefore, increased cylindrical LIB prices may well have led to even larger increases in prices of finished products that use LIBs. In the following section,

[55] Robert G. Harris and Lawrence Al Sullivan, "Passing on the Monopoly Overcharge: A Comprehensive Policy Analysis," University of Pennsylvania Law Review 128-2, Dec. 1979: 286.

[56] "Once imperfectly competitive markets are allowed, overshifting becomes a possibility and can be guaranteed in some model specifications. Overshifting can occur because of the existence of market power and strategic behavior among firms. Firms recognize that forward shifting of the tax will decrease demand for their product. Thus, under some circumstances, they will wish to raise the price more than the increase in tax to compensate for the revenue loss from decreased demand." Don Fullerton and Gilbert E. Metcalf, "Tax Incidence,"ed. A. J. Auerbach and M. Feldstein, *Handbook of Public Economics* 4(Elsevier: Amsterdam: 2002):. 1825.

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I analyze empirically the tendency of manufacturers and sellers of finished products containing cylindrical LIBs to pass increased costs to purchasers.

3. Empirical Results from the Literature

107. From the preceding discussion, it is clear that the extent to which input cost increases are reflected in output prices is ultimately an empirical issue. Fortunately, this is an area for which methods of empirical analyses are well established. Moreover, as the theory predicts, empirical studies of this topic report results which vary greatly by industry. Aaronson (2001), for example, finds undershifting of increases in the minimum wage into fast food restaurant prices.[57] However, Besley and Rosen (1999), in their study of the effects of taxes on retail prices, find overshifting in more than half of the products studied.[58] Both Kenkel (2005) and Young and Bielinska-Kwapisz (2002) find effects of taxes on alcoholic beverages prices exceeding 100 percent of the tax increase;[59] and, in the international economics literature, estimated price impacts for exchange rate-driven cost increases exceeding 100 percent are not uncommon.[60] Karp and Perloff (1989) find a pass-through in excess of 100 percent on Japanese color televisions.[61]

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[57] Daniel Aaronson, "Price Pass-through and the Minimum Wage," *The Review of Economics and Statistics* 83-1 (February 2001).

[58]Timothy J. Besley and Harvey S. Rosen, "Sales Taxes and Prices: An Empirical Analysis," *National Tax Journal* 52- 2(June 1999).

[59] Donald S. Kenkel, "Are Alcohol Tax Hikes Fully Passed Through to Prices? Evidence from Alaska," *The American Economic Review* 95- 2(May 2005); and Douglas J. Young and Agnieszka Bielinska-Kwapisz, "Alcohol Taxes and Beverage Prices," *National Tax Journal* LV- 1,(March 2002).

[60] See *e.g.*, Jose Manuel Campa and Linda S. Goldberg, "Exchange Rate Pass-Through into Import Prices," *Review of Economics and Statistics* 87- 4(November 2005); and Michael M. Knetter, "International Comparisons of Pricing-to-Market Behavior," *The American Economic Review*83-3(June 1993.

[61] Larry S. Karp and Jeffrey M. Perloff, "Estimating Market Structure and Tax Incidence: The Japanese Television Market," *The Journal of Industrial Economics* XXXVII-3(March1989).

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B. Analysis of Pass-Through of Overcharges to Class Members for LIB Finished Products

1. Data Available for Analysis

108. To study empirically the relationships between costs and prices, I was provided with cost and price datasets from several third-party companies involved in manufacturing, distribution, and retail of consumer electronics with LIBs. These include such companies as Acer (OEMs), Ingram (distributor), and PC Connection (retailer). In addition, two of the defendants, Sony and Toshiba, produced transactional sales data for finished product including itemized cost of goods sold (COGS). From these datasets I analyze electronics products that frequently contain cylindrical LIBs, namely notebooks, cameras, camcorders, and power tools.[62] A full list with descriptions of companies analyzed is presented in Appendix B.[63]

109. Many of the datasets were provided with COGS matched to individual item sales by the companies. Although there may be perfect matching, business records rarely attempt to distinguish fixed costs from marginal (incremental) costs such as batteries to be installed in finished product. This causes inevitable measurement error in the COGS. In other instances, prices and costs were provided in two separate datasets of sales to customers and purchases from suppliers. For the latter cases, I match quantity-weighted monthly average prices in the sales data with quantity-weighted monthly average costs from the purchase data. The latter dataset will be more prone to measurement error problem in the estimation of price-cost relationships. Measurement errors in costs generally reduce the correlation between measured prices and measured

---

[62] When possible, I attempted to limit the sales data to products containing cylindrical LIBs. The datasets analyzed contain a vast amount of product items and it is likely that some products included in the analysis may contain other battery types, i.e., non-lithium ion or non-cylindrical lithium ion batteries. There is no reason to expect pass-through to be different for those products.

[63] Several additional datasets from third-party entities were provided to me, however there were either incomplete or deficient for the purposes of my analysis. I understand there are pending unanswered questions from some of these third-parties and that additional data may be provided. I reserve the right to supplement and incorporate additional datasets into the analysis if additional information and data are provided.

costs, and for simple regression settings this results in a downward bias of the pass-through estimate.

110. These data allows four different types of cost and price comparisons that shed light on the pass-through question. We can do a "cross-section" comparison of the costs and prices of different products at the same point in time. We can do a "cross-section" comparison of the changes in costs and prices of different products between two points in time. We can do a "time-series" comparison of the costs and prices of the same product at different points in time. And we can do a "time-series" comparison of the changes in costs and prices of the same product over time. The data analysis discussed below includes all of these four types of comparisons, sometimes combined in the same statistical analysis.

111. I conduct my analysis for entities that sold various types of products (notebook PCs, cameras, camcorders, and power tools) at different levels of the chain of distribution for products containing cylindrical LIB cells (OEM finished product manufacturers, distributors, and retailers).

2. Pass-Through Estimates

112. To analyze pass-through across the products at issue and at different levels in the distribution chain, I perform a series of regression analyses utilizing sales and cost data from a diverse set of companies which produced price and cost data. These regressions estimate the empirical relationship between sales prices and costs of LIB products of OEMs, product distributors, and retailers (online as well as brick and mortar).[64]

113. First, I estimate a pooled regression which utilizes both cross-sectional (across products) and inter-temporal (across time) correlation of prices and costs. I

[64] I was not provided with data from non-Defendant packers to analyze for pass-through, but as described above, I have separately analyzed the effects of the cartel on cylindrical LIB packs (i.e., the per-cell overcharge on cylindrical LIB packs). There is no reason to expect the packers, who purchased cartel-impacted cylindrical LIB cells from Defendants would not have passed those overcharges through to their customers. Indeed, packers sometimes acted as agents for a Defendant, packing the cells and being paid a "commission". Samsung SDI Co., Ltd.'s Supplemental Response to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories, No. 5, January 15, 2016.

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estimate a dynamic regression which includes one lag of prices (dependent variable) and one lag of costs. This model allows for the cost effects to transfer into prices gradually, instead of immediately. The regression equation takes the form:

$$P_{it} = \beta_0 + \rho^* P_{it-1} + \beta_1^* C_{it} + \beta_2^* C_{it-1} + \varepsilon_{it},$$

where P_{it} is a weighted average unit price of product (part number or SKU) i at month t; C_{it} is a weighted average unit cost of product i at month t; ε_{it} is an error term. Observations are weighted by sales quantity. The estimate on coefficient β_1 shows how much the price changes with $1 change in the cost in the contemporaneous period. The dynamic nature of the model allows this effect to increment over time. The long-run change in prices from $1 change in costs is $(\beta_1+\beta_2)/(1-\rho)$.

114. Figure 40 shows the long-run estimates and 95 percent confidence intervals that result from 32 regressions for each company and finished product category. Twenty-nine out of 32 estimated pass-through coefficients are greater than 0.9; 26 out of the 32 are greater than 0.95; and 25 out of the 32 are greater than one, i.e. 100 percent pass-through. The collective evidence of all these experiments suggest that changes in costs are fully transferred into changes in prices. These results indicate that some portion of cost increases are passed on and close to 100 percent or more of costs are passed through in the long-run.

115. The first regression reported in Figure 40 depends on correlations between costs and prices for specific products over time but also across products at a given point in time. In other words, these results depend on all four of the comparisons discussed above. Next, I estimate a dynamic regression with fixed effects for each item reported in Figure 41, which derives the relationship solely from the inter-temporal relationship of prices and costs within each product item defined by manufacturer part number or SKU. The regression is of the form:

$$P_{it} = \beta_0 + \rho^* P_{it-1} + \beta_1^* C_{it} + \beta_2^* C_{it-1} + \Sigma\delta_i^* D_i + \varepsilon_{it,}$$

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where D_i is an indicator for each product item (manufacturer part number or SKU), referred to below as "fixed effects."

116. The confidence intervals in Figure 40 and Figure 41 refer to the long-run pass-through estimates. There are two important hypotheses that these intervals speak to: positive pass-through and 100 percent pass-through. A confidence interval that would cast doubt on the hypothesis of positive pass-through would be confined to negative values. There are none of these. A confidence interval that would favor the hypothesis of positive pass-through would be confined to positive values. All but one of the 32 intervals have this property. The other interval overlaps positive and negative values which means that in this case the experiment isn't good enough to allow testing of this hypothesis. The overall support for positive pass-through is thus very strong.

117. A confidence interval that would cast doubt on the hypothesis of 100 percent pass-through would be confined to values either in excess or below 100 percent. 20 of the 32 intervals are strictly above 100 percent; 6 are strictly below, and the remaining 6 include 100 percent. These results are obtained in a setting subject to measurement inaccuracies which can bias the estimates downward. The empirical results are entirely consistent with expectation from economic theory that the best estimate of pass-through to consumers is 100 percent and provide no support for a low pass-through rate

Figure 40: Pass-Through Estimates (No Fixed Effects)

LIB Finished Product Pass-Through Estimates Summary
No Part Number Fixed Effects

Level	Company	Notebook Estimate	Notebook 95% CI	Camcorder Estimate	Camcorder 95% CI	Camera Estimate	Camera 95% CI	Power Tools Estimate	Power Tools 95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
OEM	AOpen	0.61	(-.01,1.24)						
OEM	Acer	1.21	(1.11,1.31)						
OEM	[redacted]							1.03	(.91,1.15)
OEM	Dell	1.29	(1.26,1.32)						
OEM	Fujitsu	1.38	(1.33,1.43)						
OEM	Sony	1.04	(1.02,1.05)	1.18	(1.15,1.21)	1.11	(1.06,1.15)		
OEM	Toshiba	1.07	(1.06,1.08)						
Distributor	ASI	0.89	(.8,.98)						
Distributor	Ingram	1.02	(1.02,1.02)	1.03	(1.03,1.03)	1.03	(1.03,1.03)		
Distributor	SED	0.94	(.92,.96)						
Retailer	ABC Warehouse					1.10	(1.08,1.13)		
Retailer	ACE Hardware							1.04	(.98,1.11)
Retailer	Amazon	1.71	(.66,2.76)						
Retailer	[redacted]	1.32	(1.32,1.33)	1.47	(1.46,1.49)	1.31	(1.31,1.32)		
Retailer	CDW	0.81	(.79,.84)				1.11	(1.07,1.15)		
Retailer	Home Depot							1.10	(1.08,1.12)
Retailer	MEI	0.93	(.89,.97)	1.03	(.99,1.07)	1.00	(.99,1.02)		
Retailer	PC Connection	0.91	(.9,.92)	1.11	(1.1,1.11)	1.11	(1.1,1.11)		
Retailer	[redacted]	0.97	(.96,.97)	1.05	(1.05,1.06)	1.04	(1.03,1.05)		

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1).
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Long-Run Pass-Through estimates are presented.
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.

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Figure 41: Pass-Through Estimates (Fixed Effects)

LIB Finished Product Pass-Through Estimates Summary
Part Number Fixed Effects

		Notebook		Camcorder		Camera		Power Tools	
Level	Company	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI	Estimate	95% CI
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
OEM	AOpen	1.61	(1.11,2.12)						
OEM	Acer	1.26	(1.16,1.36)						
OEM	[redacted]							1.45	(.9,2)
OEM	Dell	1.35	(1.27,1.44)						
OEM	Fujitsu	1.10	(1.03,1.17)						
OEM	Sony	0.83	(.71,.94)	0.62	(.54,.71)	1.35	(1.26,1.43)		
OEM	Toshiba	0.82	(.8,.84)						
Distributor	ASI	0.70	(.53,.87)						
Distributor	Ingram	1.02	(1.01,1.02)	1.00	(.99,1.01)	1.04	(1.03,1.04)		
Distributor	SED	1.02	(.98,1.05)						
Retailer	ABC Warehouse					1.26	(1.19,1.33)		
Retailer	ACE Hardware							0.35	(.29,.42)
Retailer	Amazon	0.75	(.34,1.16)						
Retailer	[redacted]	0.98	(.93,1.03)	1.81	(1.73,1.9)	1.24	(1.22,1.26)		
Retailer	CDW	0.75	(.73,.78)			1.01	(.79,1.23)		
Retailer	Home Depot							0.42	(.3,.55)
Retailer	MEI	1.15	(1.12,1.19)	1.25	(1.16,1.34)	1.07	(1.03,1.1)		
Retailer	PC Connection	0.96	(.96,.97)	1.17	(1.13,1.21)	1.17	(1.16,1.18)		
Retailer	[redacted]	0.71	(.7,.73)	1.06	(.98,1.13)	0.82	(.76,.89)		

Note: (1) Dep. Var.: Unit Price
Ind. Var.: Unit Price(-1), Unit Cost, Unit Cost (-1), Part Number Fixed Effects.
(2) Best Buy produced annual data. Regression does not include any lags.
(3) Long-Run Pass-Through estimates are presented.
(4) Based on monthly average prices and costs by manufacturer part number or SKU.
(5) Quantity weighted regressions.
(6) Power Tool regressions performed with indicators for power tool product types (e.g. Cutter, Drill, Driver, Hammerdrill).
(7) Notebook regressions include an indicator for Netbooks where applicable.

3. Data Confirms Pass-Through Occurs for Small Cost Changes

118. Batteries sometimes comprise a small fraction of the total cost of the final product. There are frameworks that suggest the fraction of pass-through may be influenced by the size of the cost increase but the direction of that effect is ambiguous, i.e. smaller cost increases may be associated with higher or lower

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pass-through fractions.[65] Furthermore, pass-through can have both a long-run and a short-run component, since affected businesses may absorb part of the cost increase in the short-run but later incorporate those costs more fully onto the product prices.

119. Toshiba produced datasets containing cost breakdowns for individual components, including batteries, used in particular notebook models from 2006 through 2011. From these datasets, I have compiled costs of batteries attributed to notebook models on a quarterly (and in some cases annual) basis. I matched these battery costs with finished product prices and COGS reported in Toshiba's finished product sales transactions data. The match is done by notebook model code. It is not possible to match and analyze inter-temporal effects within each model code because the battery prices are predominantly constant within the life of each model. However, I can analyze the relationship between battery costs and notebook sales prices from the variability of battery types (e.g. different capacity) included in different notebook models (at the same or different points in time).

120. Figure 42 reports the results of a regression of notebook prices on both battery costs and all other total costs using 159 Toshiba notebook models. On average, battery costs represented about five percent of total costs. The dependent variable is the weighted average price charged by Toshiba to its customers for a notebook model. This price is regressed on the battery cost and the weighted average COGS of the notebook model less the battery cost. Even though the battery is a small cost item, the coefficient on battery cost is close to one, indicating that the battery costs are reflected approximately dollar-for-dollar in the sale prices of the notebooks.

[65] See Oxera "Quantifying antitrust damages Towards non-binding guidance for courts," Study prepared for the European Commission (December 2009):121.

Figure 42

Toshiba Notebook Battery Cost Pass-Through

Dependent Variable: Notebook Sales Price

Variable	Estimate	St. Error	T-Value	P-Value
(1)	(2)	(3)	(4)	(5)
Battery Cost	0.85	0.57	1.47	0.143
Other Costs	1.30 ***	0.02	77.52	0.000
Number of Cells				
6	-1.10	14.36	-0.08	0.939
8	-56.55	38.46	-1.47	0.144
9	-39.24	43.17	-0.91	0.365
12	-75.61	47.13	-1.60	0.111
Constant	-105.17 ***	18.50	-5.68	0.000
Quantity Weights	YES			
R-Square	0.98			
Observations	159			

Notes: (1) Other Cost defined as COGS less battery cost.

*** Statistically Significant at 99% level.

Source: Toshiba notebook sales and cost data.

121. To study whether the relationship of costs and prices is different for small incremental cost changes compared to larger changes, I estimate the regression model in Figure 43 using the Defendant and third-party finished product sales datasets, allowing for small changes in costs to have different effects than large ones. The variables in the regression are a monthly weighted average price and cost of a product part number sold by a specific OEM (e.g. Acer, Fujitsu), distributor (e.g. Ingram), or retailer (e.g. PC Connection). The dependent variable is the unit price which is regressed on the lag of the unit price, lag of the unit cost and the change of the unit cost. In addition, I flag monthly absolute cost changes which are 0-0.1%, 0.1-5%, and greater than 5% for each product part number. I interact the indicator for (0.1-5%) cost changes with

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the change in the unit cost. This allows the model to distinguish effects of relatively small incremental cost changes from larger ones. In addition, I include an indicator for less than 0.1% absolute cost change, which contain predominantly zero cost changes. The coefficients indicate that 94 percent (0.41/(1-0.566)=0.94) of costs are passed-through in the long-run and the immediate pass-through effects are statistically indistinguishable for small and large cost changes.

Figure 43

Threshold Pass-Through Regression Analysis

Variable	Estimate		Clustered Std. Error	T-Value	P-Value
(1)	(2)		(3)	(4)	(5)
Dependent Variable: Unit Price					
Unit Price(-1)	0.566	***	0.094	5.996	0.000
Unit Cost(-1)	0.410	***	0.093	4.418	0.000
Unit Cost - Unit Cost(-1)	0.582	**	0.223	2.603	0.015
Unit Cost - Unit Cost(-1)*(Abs Change (0.1% - 5%))	-0.086		0.064	-1.337	0.192
Abs Change (0.1% - 5%) Indicator	-6.778	***	2.289	-2.962	0.006
Abs Change (0% - 0.1%) Indicator	-8.243	**	3.480	-2.369	0.025
Constant	50.236	**	21.029	2.389	0.024
Part Number Fixed Effects	YES				
Quantity Weights	YES				
R-square	0.996				
Number of Observations	363,713				
Number of Companies	18				
Number of Notebook Part Numbers	101,915				

*** Statistically Significant at 99%; ** Statistically Significant at 95%; Statistically Significant at 90%.

Notes:
(1) Clustered Robust Standard Errors computed at company-product category level (29 clusters).

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VIII. A Method for Calculating Damages

122. I report in this section a preliminary calculation of damages to Class Members based on the overcharges estimates reported in Figure 34 above as well as data on the volume of sales.

123. Figure 44 reports the Defendants' global sales volume of cylindrical LIB cells and cylindrical LIB cells sold in packs by year for all Defendants.[66] Using industry data, I calculate the share of finished products that are under within the scope of the class i.e. notebook PCs, camcorders and power tools and apply the U.S. share of global sales of portable consumer electronics sales (notebook PCs - the major product in which cylindrical LIBs are used).[67] I calculate the number cylindrical LIB cells that were purchased by Class Members in the U.S. either incorporated into finished products or as replacement batteries.

124. Figure 44 also shows the average dollar per unit overcharges that I calculated from my estimates of the impact of the cartel on cylindrical LIB cells and cylindrical LIB cells in packs. I calculate the global overcharges by multiplying the dollar per unit overcharges by the number of cylindrical LIB cells Defendants sold in the U.S. I do this calculation for both Defendants' cylindrical LIB pack sales and their cylindrical LIB cell sales.

125. The next step is to adjust those overcharge amounts for the extent of pass-through to Class Members into their finished product purchases. For example, if I concluded that the best estimate of the pass-through rates were 110 percent by the finished product OEM, 95 percent by the finished product distributor, and 100 percent by the retailer, the appropriate calculation would be to multiply these percentages to obtain a combined pass-through rate, e.g. 104.5 percent with the figures above. As I describe above, overcharges may be more than or less than 100 percent but, based on the economic literature, theoretical

[66] Using Defendants' transactional datasets except for NEC, which did not provide sufficient information to incorporate transactional sales data. NEC's sales are estimated using industry data on its global market share.

[67] These are calculated using market data from Display Search Data ("DS_2011Q2_Econ One Custom Project_Revised.xls"), PANA-C000076205 and SONY-LIB-000893992

and empirical, the starting hypothesis for the pass-through rates at each of these levels is 100 percent. There is some evidence that suggests the total pass-through may have been higher overall. However, I do not find sufficiently strong evidence to lead me to conclude the rate was greater than 100 percent. Therefore, I apply a 100 percent pass-though rate to the cylindrical LIB overcharges in the cylindrical LIB finished products.

Figure 44: Preliminary Damages Calculation

All Defendant Cylindrical LIB Damages

	Cells	Cells in Packs	Total
			(1) + (2)
	(1)	(2)	(3)
Global Sales of Class Products During Class Period (Thousand Units)	3,554,599	3,796,597	7,351,195
U.S. Sales During Class Period (Thousand Units)	1,066,380	1,138,979	2,205,359
Overcharge During Class Period (%)	18.6 %	13.9 %	
Overcharge During Class Period (USD/Cell)	$ 0.36	$ 0.51	
Damages Based on a 100% pass-through (USD Thousand)	$ 381,545.15	$ 585,489.74	**$ 967,034.89**

Note: Class product sales are based on market data on cylindrical sales by application. U.S. share of global sales based on U.S. regional share of global notebook sales. NEC's sales calculated from market share data.

Source: Defendants Transactional Sales Data, Overcharge Regression Results, PANA-C000076205, SONY-LIB-000893992 Display Search Data (DS_2011Q2_Econ One Custom Project_Revised.xls).

IX. Conclusions

126. I have conducted a statistical analysis which strongly supports the conclusion that cylindrical cells and cylindrical packs have a stable structure of prices which would spread the effect of a price-fixing conspiracy to all or almost all of the batteries in this group. This stable structure comes from substitutability on

the demand side, on the supply side and from the way prices are coordinated by sellers.

127. Regression analysis using defendant data on prices and sales of cylindrical LIBs is capable of identifying overcharges received by the defendants for the LIB batteries installed in products purchased by class members during the class period.

128. The harm suffered by the indirect class members depends on the extent to which the increased battery price is passed down the supply chain from battery manufacturer to finished-product manufacturer to wholesaler to retailer to final customer. Economic theory allows a wide variety of outcomes including greater than 100 percent pass-through or less than 100 percent pass-through. Empirical analysis that I have conducted comparing costs and prices of products that include LIBS produces estimates that are roughly in balance above and below 100 percent pass-though. Pending receipt of more relevant evidence, I have therefore used in this report a pass-through rate of 100 percent.

129. The total amount of overcharges suffered by class members during the class period is estimated at $967 million.

Edward E. Leamer, Ph.D.
February 2, 2016

APPENDIX A. LIB Sales Data

A. Defendant Overall Data and Preparation of Battery Sales Data for Cylindrical Cells and Cylindrical Cells in Packs

Figure 45 : Data Availability Summary

Summary of Cylindrical Battery Sales Data with Available Capacity and Dimension
Number of Cells Sold (Single Cells and Packs)

Manufacturer	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
	(Million Units)																	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)
HITACHI-MAXELL	-	-	0.00	0.03	1.06	3.81	0.45	-	-	-	-	0.62	2.88	8.39	14.34	14.65	5.92	-
LGC	-	-	-	-	-	-	-	-	13.65	39.09	87.19	85.88	239.64	340.86	445.48	508.76	580.89	0.00
PANASONIC	-	-	-	-	7.61	24.66	97.19	56.13	60.83	138.55	136.27	125.98	169.92	192.89	126.67	15.63	5.64	-
SAMSUNG	-	-	-	0.18	9.83	21.37	37.84	45.18	87.08	109.11	181.71	322.28	405.57	552.53	682.70	760.43	597.92	-
SANYO	28.34	17.46	19.70	26.12	38.45	50.26	76.78	110.81	133.96	147.39	191.13	242.60	239.84	299.98	305.81	351.77	255.64	-
SONY	13.32	59.69	67.34	89.93	92.47	88.58	97.55	108.29	119.89	131.36	130.09	171.80	161.28	188.39	124.67	90.33	73.58	15.56
TOSHIBA	5.72	4.59	11.01	8.01	4.37	13.83	14.57	2.58	0.13	-	-	-	-	-	-	-	-	-

Note: Shaded years represent the Class Period of January 1, 2000 to May 31, 2011.
Restricted to data with available capacity and dimension.
Source: Defendants Transactional Sales Data.

130. My analysis uses data produced by Defendants for their global lithium-ion cells and packs. From this data, I extracted sales for cylindrical cells and packs. The individual defendant data were combined into a common format.

131. As described below, the raw datasets did not provide sufficient information to fill in all fields in the dataset and the data needed to be supplemented from various sources, including other defendant documents and product spec sheets and roadmaps. This process utilizes the best available information to me currently. I reserve the right to supplement and revise the data and analysis produced in this report as new information becomes available or if Defendants produce additional data.

132. Figure 45 summaries the availability of useable data. The creation of this dataset was challenging due to incompleteness of the original information, in particular with respect to product characteristics. The product characteristics I have used in my analysis are cell vs pack identification, number of cells in the pack (for packs), dimension and capacity for the cell or the cell in the pack. These originated from four sources: (i) fields in the defendants' own transactional data; (ii) supplemental data, e.g., separate product characteristic information (e.g., lookup tables) from defendants in response to questions; (iii)

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product code decoders provided by defendants or inferred from common naming conventions; and (iv) product research to locate specific information in defendants' production data, and public sources describing product characteristics.

133. With the exception of Samsung, for the large majority of the product codes in the data, capacity information had to be researched and entered one product code at a time. My staff searched public documents and produced documents (including product specification sheets, online catalogs, and documents often called "product roadmaps"[68]) for capacity information by product code. Capacity was sometimes provided in these documents as typical or actual capacity, and sometimes as minimum capacity. I used typical capacity when it was available, which is for about 90.6 percent of cell shipments in the defendants' data. Where typical was unavailable, but minimum was, I scaled the minimum capacity up by five percent.[69] This needed to be done for only 1.6 percent of shipments. Additional characteristics, such as energy density, were not commonly available.

134. In order to fill in the capacity and dimension of the cell in the pack for packs, I needed information regarding the cell type or product code of the cell in pack which was not provided by all defendants. As described below, I also supplemented this information from various defendant documents where it was not available directly in the transactional sales data.

135. The collected product characteristics data was merged with the transactional sales data to create the data for analysis. I utilized an outlier filter which removed transactions with prices under the 1st percentile or over the 99th percentile, computed over a year-quarter, dimension and capacity range. In addition to that, any transactions with prices under 30 cents per cell, price over

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[68] Product road maps describe a set of products from one or more defendants, the capacities they currently had and those planned to have in the near future. Product spec sheets typically provide additional information but these weren't always available. Additionally, for certain defendants, lists of cell codes with capacity information were located such as SONY-LIB-000820615 (tab "Cell") and SANYO-C000625107E.

[69] See e.g., SANYO0136494 at 506.

$50 per cell or quantity less than 10 for cell transactions were also removed. These filters result in fewer than 2 percent of transactions being removed.

B. Hitachi-Maxell

136. Hitachi-Maxell produced data separately for Hitachi Corporation (global sales) for years 2001-2013 and Maxell Corporation of America (MCA – US sales) for years 1999-2013.

137. Hitachi Corporation's data included type (shape) of cell and whether the battery was a cell or a pack. The number of cells in a pack and the product code for cell in the pack were determined based on the pack's product code. Information for cell shape, number of cells in the pack and type of cell in the pack was not provided directly in the MCA data and supplemented using Hitachi global data where possible.

C. LG Chem

138. LG Chem produced LIB sales data for years 2002-2013 with almost all of the data involving sales transactions after 2005, from its headquarters, LG Chem America (LGCA), LG Chem Europe (LGCE) and LG Chem Nanjing (LGCN).

139. Cell vs. pack and type of cell are identified in the majority of LG Chem's data, but number of cells in the pack was missing for a large proportion of pack transactions. This was filled in using a letter in the suffix of the product code. In addition, product code for cell in the pack was directly available for some product codes and supplemented for the remaining using information extracted from the pack product and lookup tables constructed from supplemental data files produced by LGC and located by my staff.

D. NEC

140. NEC produced sales data for years 1998-2013 including sales of lithium ion batteries and non-LIB products. To the extent the type of lithium ion battery could be identified from the data, sales of cylindrical batteries are limited to 1998-early 2001 with dwindling sales beginning in 2000. This is consistent with

NEC's decision in early 2000 to divest its cylindrical battery operations to focus on prismatic batteries.[70]

141. I have not incorporated NEC data in the analysis so far because of the complexity and incompleteness of the data. Product characteristics such as cell vs. pack, number of cells per pack and type of cell were absent in the majority of NEC sales data. Also, it is hard to distinguish cylindrical cell data from other products. Sales data from NEC Tokin, for example, contains automotive batteries and development costs and labels as product names.

E. Panasonic

142. Panasonic produced battery sales data for fiscal years 1997-2013 from Panasonic North America (PNA), Panasonic Japan Marketing and Sales, Matsushita Battery Industrial (MBI), Panasonic Canada Inc. (PCI) and Panasonic Industrial Devices Sales (PIDS) entities in various locations worldwide. Panasonic also produced a product decoder for cell model numbers.

143. Panasonic stated that sales data from MBI contained internal transfer data and prices that do not reflect prices to the end customer.[71] Panasonic subsequently produced data from various entities reflecting sales to external customers, and therefore, I did not use the MBI data other than to obtain product codes of cells used in packs or cells and number of cells per pack. Excluding the MBI data, sales data begins in fiscal year 2001.

144. Product type (shape) was available in the data, and where it wasn't it was obtained from product codes using the decoders, for most products. Product characteristics such as cell vs. pack, number of cells per pack, cell codes, dimension and capacity were generally absent in Panasonic sales data. Internal sales data and other documents produced by Panasonic were used to build

[70] "NEC Moves to Strengthen its Lithium Ion Battery Operations," NEC Corporation, http://www.nec.co.jp/press/en/0001/1301.html.

[71] 2015-09-21 Letter from Jeffrey J. Amato to Marc A. Pilotin re Panasonic data, Answer to Question 21.

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lookup tables cross-referencing Panasonic product codes to cell codes and their cell characteristics.

F. Samsung

145. Samsung produced SDI global sales data of LIB cells and packs for years 2000-2013. Information on whether a product code represents a cell or a pack and the type (shape) of the cell was available in the data. Defendant also provided data on determining the product code of cells in a pack.

146. The product decoder provided by Samsung[72] allowed identification of cell capacity from the cell product code and for packs, it helped determine the number of cell inside a pack.

G. Sanyo

147. Sanyo produced transactional sales data for Sanyo Electronics Corporation (SEC), Sanyo North America Corporation (SNA), Sanyo Fisher Company (SFC) and Sanyo GS Soft Energy (SGS). Sanyo produced SEC sales from 1997 to 2013 and a separate file with sales to NOKIA for the same period. They also produced SEC Internal Sales from 2000 to 2013. This file was deemed incomplete and not incorporated into the dataset. SGS battery sales data from 2004 to 2011 also included internal sales.

148. Sanyo produced other subsidiaries sales as follows SNA sales covering the periods 1997 through 2013; SNA battery sales for phones from April 2001 to March 2003; and Sanyo Fisher sales from 2000 through 2013. These datasets were deemed incomplete and product codes were not consistent as a result they were not used for my analysis.

149. The majority of the usable transactions data included the cell type, cell vs. pack, number of cells in the pack and cell code for cell in the pack.

[72] See SDI-B-000059908.

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H. Sony

150. SONY produced sales datasets from various systems including ATLAS, TACT, STN, ORACLE and COMS. As per communications, COMS data contained monthly summary of all of SONY's battery sales.[73] The COMS dataset covers battery sales for the period 1997 through 2013. The COMS data is used as it seemed the most complete dataset despite being a monthly summary and not transaction level data.

151. The data included information on whether the product sold was a cell or a pack, type of cell, number of cells in the pack and the product code of cell used in pack (for packs).

I. Toshiba

152. Toshiba produced transactional sales data for 1997-2007. Toshiba produced data from Toshiba America Electronic Components (TAEC) and Toshiba Corporation. Both sets of data start in 1997. Toshiba stopped production of lithium-ion battery cells and packs in 2004[74] and had dwindling sales thereafter. In Toshiba Corporation's data, December 2007 is the last transactional date. The number of observations and the quantity sold decline sharply after 2005. The TAEC data ends in 2004. Toshiba provided some information on how to distinguish cells from packs and how to identify type of cell from a cell's product code and identify number of cells in packs, where such information was missing. For cells, dimension was obtained from product code. Toshiba did not produce product code of cell used in pack and this was supplemented to the extent possible, from additional documents produced by Toshiba and located by my staff.

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[73] *In re Lithium Ion Batteries Antitrust Litigation,* No. 13-md-02420 YGR (DMR) – Transactional Data Questions, September 8, 2015.

[74] Toshiba Corporation's Supplemental Objections and Responses to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories to Defendants, April 16, 2015, 8. ("Toshiba Supplemental Responses to 1st Rogs")

APPENDIX B. Description of Third Party and Defendant Finished Product Sales Data

A. Summary of Data Used in Pass-Through Analysis

153. Figure 46 provides a summary of the datasets used in pass-through analysis. For each company, the products analyzed, the year coverage of the data, number of transactions, number of units sold, revenues, and number of individual product items distinguished by part number or SKU.

Figure 46

Pass-Through Analysis Data Summary

Level	Company	Product	Year Coverage	Number of Observations	Units Sold	Sales	Number of Product Models
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
OEM	AOpen	Notebook	2002-2010	473	52,076	$ 23,385,006	85
OEM	Acer	Notebook	1999-2006	467	2,287,257	1,994,191,329	108
OEM	[redacted]	Power Tool	2006-2011	1,745	1,750,553	348,502,402	93
OEM	Dell	Notebook	2004-2009	1,596	3,747,724	5,128,967,876	80
OEM	Fujitsu	Notebook	2001-2011	56,943	596,793	943,044,631	33,891
OEM	Sony	Camcorder	1997-2013	8,942	27,042,252	11,909,933,304	442
OEM	Sony	Notebook	2000-2013	221,623	11,571,157	11,314,450,810	143,128
OEM	Sony	Camera	1997-2013	7,519	50,176,832	12,551,534,359	399
OEM	Toshiba	Notebook	1999-2011	237,510	34,096,182	27,848,062,008	146,836
Distributor	ASI	Notebook	2001-2011	3,212	186,476	105,416,197	1,150
Distributor	Ingram	Notebook	2003-2011	66,312	6,201,745	6,576,642,905	12,235
Distributor	Ingram	Camcorder	2003-2011	4,843	195,232	60,618,476	568
Distributor	Ingram	Camera	2003-2011	13,410	1,453,371	330,433,922	1,552
Distributor	SED	Notebook	2004-2009	4,586	547,813	307,227,107	1,447
Retailer	ABC Warehouse	Camera	1998-2008	3,181	160,926	36,312,000	183
Retailer	ACE Hardware	Power Tool	2010-2015	1,741	72,597	9,332,886	61
Retailer	Amazon	Notebook	2007-2008	1,272	60,845	61,364,741	335
Retailer	Best Buy	Camera	2000-2011	3,247	47,075,394	12,302,731,508	1,828
Retailer	Best Buy	Notebook	2000-2011	4,087	43,576,232	30,809,816,844	2,859
Retailer	Best Buy	Camcorder	2000-2011	1,678	13,573,005	5,148,798,618	858
Retailer	CDW	Notebook	2009-2011	21,579	1,297,990	1,333,080,276	4,625
Retailer	CDW	Camera	2009-2011	371	29,783	3,700,944	59
Retailer	Home Depot	Power Tool	2009-2012	4,760	131,233	19,066,511	617
Retailer	MEI	Notebook	2008-2011	3,883	695,844	381,977,424	517
Retailer	MEI	Camera	2008-2011	4,742	182,942	29,489,686	392
Retailer	MEI	Camcorder	2008-2011	1,306	22,962	6,018,823	104
Retailer	PC Connection	Notebook	2000-2012	73,574	1,638,432	2,076,189,673	16,334
Retailer	PC Connection	Camera	2000-2012	18,971	327,277	107,549,664	2,744
Retailer	PC Connection	Camcorder	2000-2012	6,659	151,980	57,258,762	887
Retailer	[redacted]	Camcorder	2007-2015	2,344	19,693	4,745,316	802
Retailer	[redacted]	Notebook	2007-2015	80,142	1,121,717	1,246,016,146	35,458
Retailer	[redacted]	Camera	2007-2015	13,017	116,361	14,554,681	4,343
Total				**875,735**	**250,160,676**	**$133,090,414,838**	**415,020**

Note: (1) 1st and 99th percentile of prices and costs for each product-year removed as outliers.
(2) Transactions removed if notebook price<$100; camera and camcorder price<$20; power tools<$10.
(3) Number of observations is the total number of monthly records for all model codes (annual in case of Best Buy).

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B. LIB Product Manufacturers (OEMs)

1. AOpen

154. AOpen is a publicly held corporation headquartered in Taiwan that is active worldwide in the electronics manufacturing sector, specializing in form factor computing for a wide range of consumer and business hardware and software.[75]

155. AOpen provided transactional-level sales and cost data for notebooks for the 2002-2010 period. The data include number of units sold and sales revenues for each Notebook with a manufacturing part number and a description of the item. In addition, the data contain costs of the items matched with the sales prices for each transaction.

2. Acer

156. Acer, Inc., is a hardware and electronics corporation that engages in the provision of information technology (IT) products and solutions. It is involved in the research, design, marketing and distribution of personal computers, notebooks, IT products smart hand held and tablet products.[76]

157. Acer produced transaction-level data of their notebook sales from 1999 to 2006. These data include the price, quantity and cost of goods sold for each transaction as well as the associated item model code.

3. Black and Decker

158. Stanley Black & Decker, Inc. is a diversified global manufacturer of power tools, hand tools and mechanical access solutions such as automatic doors,

[75] "About Us," AOpen. http://www.aopen.com/global/about-us.

[76] "Forbes The World's Biggest Public Companies – Acer," Forbes, http://www.forbes.com/companies/acer/.

locking systems, and electronic security systems. It also manufactures and markets industrial tools and security solutions.[77]

159. [redacted] has provided aggregate monthly level data of various types of power tools (such as drills, drivers, saws, etc.) for the period of 2006-2011. The data contain item SKU, item description, shipment quantity, total payment, and associated total cost associated.

4. Dell

160. Dell is a global privately held company headquartered in the United States that manufactures, distributes, and retails a wide range of electronic products and services, including servers and client computing devices such as desktop and notebook PC's and tablets.[78]

161. Dell provided transaction-level sales and cost data of notebooks for the 2004-2009 period. The data include the number of units sold and sales revenue for each notebook with a model number and short item description. In addition, the data contain costs of the notebooks matched with the sales prices for each transaction. [79]

5. Fujitsu

162. Fujitsu is a publicly held company headquartered in Japan that is active worldwide, and develops, manufactures, and distributes a range of technology products and services, including notebooks, desktop computers, tablets, and servers.[80]

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[77] "Forbes The World's Biggest Public Companies – Black & Decker," Forbes, http://www.forbes.com/companies/stanley-black-decker/ and "10-K," Stanley Black & Decker (2014), 3.

[78] "10-K," Dell Corporation (2013), 4-5.

[79] The revenues and costs produced in the data were broken down into components and had to be summed to generate transaction totals. See Email from Matthew D. Kent to Attached Service List, *Re: In re Lithium Ion Batteries Antitrust Litigation,* Case No. 13-md-2420-YGR (DMR), (January 8, 2016).

[80] "Fujitsu at a Glance," Fujitsu, http://www.fujitsu.com/global/about/corporate/info/.

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163. Fujitsu provided transaction-level sales and cost data of notebooks for the 2001-2011 period. The data include the number of units sold and sales revenue for each notebook, with a unit number and description. In addition, the data contain costs of the items matched with the sales prices for each transaction.

6. Sony

164. Sony is a publicly held corporation headquartered in Japan that is active worldwide in the development, manufacturing and sale of consumer, professional, and industrial electronic equipment, including cameras, tablets, and TV's.[81]

165. Sony provided transaction-level sales and cost data of camcorders, cameras, and notebooks for the 1997-2013 period. The data include the number of units sold and sale price for each item with a model code and description. In addition, the data contain costs of the items matched with sales prices for each transaction.

7. Toshiba

166. Toshiba is a publicly held corporation headquartered in Japan that is active worldwide in the development and manufacture of a range of consumer, business, and industrial electronics, including laptops, tablets, TV's, and camcorders.[82]

167. Toshiba provided transaction-level sales and cost data for notebooks for the 1999-2011 period. The data include the number of units sold and the unit price for each item with a part number and description. In addition, the data contain costs of the items matched with sales prices for each transaction.

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[81] "20-F," Sony Corporation (2015), 27.

[82] "About Us," Toshiba, http://www.toshiba.com/tai/about_us.jsp.

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C. LIB Product Distributors

1. ASI

168. ASI Corp. is a national distributor of IT hardware and software products; maintaining several sales warehouse locations in the US and Canada.[83]

169. ASI produced transaction-level sales and purchase order datasets for notebooks each with an associated SKU number covering the 2001-2011 period. For each SKU number and month, I match weighted average prices charged by ASI in the sales data to weighted average prices paid by ASI in the purchase data. Approximately 50 percent of the monthly aggregated sales records were matched with costs.

2. Ingram

170. Ingram Micro Inc., a Fortune 100 company, is a wholesale technology distributor of a large variety of technology and mobility products from leading companies, such as Acer, Apple, Cisco, Citrix, Hewlett-Packard ("HP"), IBM, Lenovo, Microsoft, Samsung, Symantec, VMware and many others."[84]

171. Ingram provided transactional level datasets for the 2003-2011 period that include sales and costs of notebooks, cameras, and camcorders. Relevant products were retained based on the product description table provided by Ingram.[85] The datasets contain price, cost, quantity as well as unit cost, unit price, item description and SKU number to each transaction.

3. SED

172. SED International Holdings, Inc. is a multinational distributor of computer technology, consumer electronics, and small appliance products, whose

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[83] "About Us," ASI, http://www.asipartner.com/Company/AboutUs/tabid/89/Default.aspx.

[84] "10-K," Ingram Micro Inc. (2015), 3.

[85] See Email from Angela J.Yu, to Shana Scarlett, Subpoena to Ingram Micro Inc. in *In re Lithium Ion Batteries Antitrust Litigation*, Case No. 4:13-md-02420-YGR (September 18, 2015).

business scope covers Business-to-Business, Business-to-Consumer and E-commerce markets.[86]

173. SED International provided transaction-level data for the period of 2004-2009, which contain unit price, unit cost, and quantity sold, as well as product code and product description.

D. LIB Product Retailers

1. ABC Warehouse

174. ABC Warehouse is a privately held company that is both headquartered and conducts business in the United States. It retails a variety of consumer electronics, including digital cameras, camcorders, televisions, and computers.[87]

175. ABC Warehouse provided transaction-level sales and cost data of cameras for the 1998-2008 period. The data include the number of units sold and sale price for each camera with an item number and short description. In addition the data contain vendor cost of the cameras matched with the sales price for each transaction.

2. ACE Hardware

176. Ace Hardware Corporation is a retailers' cooperative of hardware including various power tools with over 4,500 locations around the globe.[88]

177. ACE Hardware provided transaction-level sales and purchase datasets for various power tools. The sales data cover the period of 2009 to 2015 and the purchase data cover 2010 to 2015. I collapsed both sales and purchase data into monthly aggregations based on item description, item code, and the month when transaction occurred. I match weighted average monthly price charged to

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[86] "SED International, Inc.," LinkedIn, https://www.linkedin.com/company/sed-international-inc-.

[87] "About ABC Warehouse," ABC Warehouse, http://www.abcwarehouse.com/abc_warehouse/abc_default.asp~active_tab~ABC%20Warehouse.

[88] "Career Opportunities,", ACE Hardware, http://www.acehardware.com/corp/index.jsp?page=jobs

consumers with weighted average monthly cost of the item from purchase data. After eliminating invalid Slightly over half of the monthly aggregated sales records were successfully matched with costs.

3. *Amazon*

178. Amazon.com, Inc. provides online retail shopping services. Through its retail websites Amazon sells various electronic products directly to consumers.[89]

179. Amazon provided transaction-level data of notebook sales for the period between January 2007 and August 2008. These data contain number of units sold, price, and cost recorded for each transaction. In addition, the data contain an item number for each notebook.

4. [redacted]

180. [redacted] is a multinational retailer, which provides consumer electronics, home office products, entertainment products, appliances and related services.[90]

181. [redacted] provided an aggregated annual sales and cost data for notebooks, cameras, and camcorders for the period of 2000-2011. These data include price, quantity and cost with item SKUs and item descriptions.

5. *CDW*

182. CDW is a publicly held corporation headquartered in the United States which provides integrated information technology solutions to business, government, education and healthcares customers.[91] CDW sells various electronic products and offers IT solutions as a U.S. sales channel partner for many OEMs.[92]

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89 "Forbes The World's Biggest Public Companies – Amazon," Forbes, http://www.forbes.com/companies/amazon/.

90 "Forbes The World's Biggest Public Companies – [redacted] " Forbes, http://www.forbes.com/companies/best-buy/.

91 "10-K," CDW Corporation (2015).

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183. CDW provided transaction-level sales data for camcorders, cameras, and notebooks for the 2009-2011 period. The sales data include number of units sold and sales revenue for each item, with a manufacturing part number, item code, order date and short item description. Separately, it provided purchase data which include purchase order quantity, cost, item code, and purchase order date. I combined the sales and cost data by matching the weighted average monthly sales price with a weighted average purchase price using item code.

6. Home Depot

184. The Home Depot, Inc. is the world's largest home improvement retailer based on Net Sales in 2015. It operates the Home Depot stores, which provides full-service and warehouse-style stores that sell a wide assortment of building materials and home improvement products including power tools.[93]

185. Home Depot provided sales and cost data of power tools with lithium ion batteries. In particular, it provided data from direct-to-consumer sales, originating from its direct fulfillment centers, purchased and sold directly from the vendor ("Epiphany Database"). This dataset contains transaction-level sales and costs with item numbers and item description. In addition, Home Depot provided merchandizing data representing purchases and sales of power tools that occur at retail stores, online, and/or distribution centers ("Teradata").[94] However, Teradata sales are at an annual aggregate level, thus not utilized for analysis.

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[93] "10-K," The Home Depot, Inc. (2015), 1. See also "Forbes The World's Biggest Public Companies- Home Depot," Forbes, http://www.forbes.com/companies/home-depot/.

[94] See Email from Lindsay Sklar Johnson, to Shana Scarlett, Re: *In re Lithium Ion Batteries Antitrust Litigation*, MDL No. 2420 (December 23, 2015).

7. MEI

186. Micro Electronics Inc. is a computer and electronics retailer with over 30 retail locations.[95]

187. MEI provided transaction-level data of notebooks, cameras, and camcorders covering the period of 2008-2011. Relevant products were retained based on the product descriptions table provided by MEI Inc.[96] The datasets contain number of units sold, unit price, and unit cost matched with each sales transaction.

8. PC Connection

188. PC Connection is a publicly held corporation that is both headquartered and active in the United States. PC Connection sells a wide range of technology products, including camcorders, cameras, laptops, and desktops.[97]

189. PC Connection provided transaction-level sales and cost data of camcorders, cameras, and notebooks for the 2000-2012 period. The data include the number of units sold and sales revenue for each item, as well as an associated manufacturing part number and description. In addition, the data contain costs of the items matched with the sales prices for each transaction. [98]

9. PCM

190. PCM is a publicly held corporation that is both headquartered and conducts business in the United States. PCM distributes and retails a large number of

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[95] MICRO ELECTRONICS INC," Vault, http://www.vault.com/company-profiles/general-consumer-products/micro-electronics,-inc/company-overview.aspx.

[96] See attachment to Email from Mark W. Haase, to Shana Scarlett, Re: Lithium Ion Batteries Antitrust Litigation Plaintiff Counsel's subpoena to Micro Electronics Inc. (September 18, 2015).

[97] "About Us," PC Connection, http://www.pcconnection.com/IPA/Content/About/PCCB2B/Default.htm.

[98] Certain observations which were found to correspond to credit memos, service plans, and customer returns were dropped. See Email from Steven E. Grill to Shana Scarlett, *RE: LIB - Questions regarding PC Connection data* (August 6, 2015).

technology products and services, including computers, monitors, scanners and printers.[99]

191. PCM provided transaction-level sales and cost data of camcorders, cameras and notebooks for the 2007-2015 period. The sales data include number of units sold and sales revenue for each item, with a manufacturing part number, order date, and short item description. Separately, they provided cost data including purchase order quantity, cost, manufacturing part number, and purchase order date. I combined the sales and cost data by matching the monthly weighted average sales price with the monthly weighted average cost using manufacturing part number and month.

APPENDIX C. Defendants and Relevant Subsidiaries

A. Hitachi-Maxell

192. Hitachi Maxell, Ltd. ("HML") is wholly owned by Hitachi, Ltd, a Japanese corporation, and was founded in 1961.[100] HML manufactures and sells lithium ion batteries and battery products through its subsidiaries around the world.[101] Maxell Corporation of America ("MCA") was established in 1969 and is a full line supplier of OEM and consumer batteries.[102]

B. LG-Chem

193. LG Chem, Ltd. is a Korean chemical company whose parent is LG Corporation. Its product line-up of lithium ion batteries ranges from small batteries for mobile devices to advanced automotive batteries and batteries for

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[99] "About Us," PCM, http://www.pcm.com/n/About-Us/navLinks-151#.

[100] "Hitachi and Hitachi Maxell Announce Making Hitachi Maxell a Wholly Owned Subsidiary of Hitachi via a Share Exchange,", Hitachi Ltd., http://www.hitachi.com/New/cnews/f_100224b.pdf, 1-3.

[101] Defendant Hitachi Maxell, Ltd.'s Amended Objections and Responses to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories, April 3, 2015, 5.

[102] "Our Company," Maxell USA, http://maxell-usa.com/about.html.

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power storage.[103] LG Chem America, Inc. is a wholly-owned American subsidiary of LG Chem, Ltd.

C. NEC

194. NEC Corporation, a Japanese corporation, manufactured and sold lithium ion batteries through its subsidiaries, including NEC Mobile Energy Corporation (formerly "Moli Energy"), NEC TOKIN Corporation and NEC Energy Devices, Ltd.[104] NEC divested its cylindrical battery business in 2000.[105]

D. Panasonic

195. Panasonic Corporation, formerly known as Matsushita Electric Industrial Co., Ltd. ("MEI") until October 2008, is a Japanese corporation mostly known for its Panasonic brand worldwide.[106] Panasonic manufactured its lithium-ion batteries and battery products through its wholly-owned subsidiary in Japan, Matsushita Battery Industrial ("MBI"),[107] which later became an internal divisional company in October 2008,[108] and other manufacturing subsidiaries. Panasonic developed its first lithium-ion rechargeable batteries in 1994.[109]

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[103] "Product," LG Chem, http://www.lgchem.com/global/product.

[104] NEC Corporation's Supplemental Objections and Responses to Plaintiffs' First Set of Interrogatories, March 31, 2015, 8-9.

[105] "NEC Moves to Strengthen its Lithium Ion Battery Operations," NEC Corporation, http://www.nec.co.jp/press/en/0001/1301.html.

[106] "Matsushita Electric Becomes Panasonic Corporation," Panasonic Corporation, http://news.panasonic.com/press/news/official.data/data.dir/en081001-4/en081001-4.html.

[107] Supplemental Objections and Responses of Defendants Panasonic Corporation and Panasonic Corporation of North America to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories, April 28, 2015, 11. ("Panasonic Supplemental Responses to Pls. 1st Rogs"). See also "Panasonic to Expand Lithium Ion Battery Production in Japan", Panasonic Corporation, November 15, 2007. http://news.panasonic.com/press/news/official.data/data.dir/en071115-1/en071115-1.html.

[108] "Matsushita Electric Becomes Panasonic Corporation," Panasonic Corporation, http://news.panasonic.com/press/news/official.data/data.dir/en081001-4/en081001-4.html.

[109] "Company History," Panasonic Corporation, http://panasonic.net/energy/battery/about_us/history/.

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196. Panasonic Corporation of North America ("PNA") is a wholly-owned American subsidiary of Panasonic Corp., and sold lithium ion batteries and battery products and a variety of finished products incorporating lithium ion battery packs, including notebook computers, digital cameras and camcorders and power tools, during the Class Period.[110] Panasonic-manufactured lithium ion cells and packs and finished products were also sold through various sales subsidiaries and/or affiliates of Panasonic Corp. located worldwide.[111]

197. In December 2009, Panasonic acquired a majority ownership of Sanyo Electric Co., a rival manufacturer of lithium ion batteries and co-defendant,[112] and made Sanyo a wholly-owned subsidiary in 2011.[113]

E. Samsung

198. Samsung SDI Co. Ltd. is a Korean corporation and is roughly 20 percent owned by the Korean conglomerate Samsung Electronics, Inc.[114] Samsung SDI entered the lithium ion battery business in 2000 and has established itself as a global leader in the market.[115] Samsung SDI America, Inc. is a wholly-owned American subsidiary of Samsung SDI Co., Ltd.

F. Sanyo

199. Sanyo Electric Co., Ltd was a leading manufacturer and supplier of lithium ion batteries located in Japan. Co-defendant Panasonic acquired a majority

[110] Supplemental Objections and Responses of Defendants Panasonic Corporation and Panasonic Corporation of North America to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories, April 28, 2015, 2. ("Panasonic Supplemental Responses to Pls. 1st Rogs").

[111] Panasonic Supplemental Responses to Pls. 1st Rogs, 3.

[112] Lance Whitney, "Panasonic takes control of Sanyo," *CNET*, December 10, 2009.

[113] "Corporate History," Panasonic Corporation, http://www.panasonic.com/global/corporate/history/chronicle.html.

[114] "Stock Information," Samsung SDI, http://www.samsungsdi.com/about-sdi/ir/stocks/shareholders.

[115] "Small-Sized Li-ion Battery," Samsung SDI, http://www.samsungsdi.com/lithium-ion-battery/overview.

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ownership in Sanyo Electric in December 2009, and Sanyo Electric was made a wholly-owned subsidiary in 2011.[116] The Sanyo brand ceased to exist in 2012.[117]

200. During the Class Period, Sanyo Electric owned manufacturing facilities of lithium-ion battery cells and/or packs. SANYO GS Soft Energy Co., Ltd, a joint venture between Sanyo Electric and GS Yuasa Corporation, also manufactured lithium ion batteries for mobile devices.[118]

201. Sanyo North America Corporation ("SNA") was a wholly-owned American subsidiary of Sanyo Electric Co., Ltd. SNA's divisional subsidiary of Sanyo Energy (USA) Corporation, along its own subsidiary Sanyo Fisher Company, handled its lithium ion battery business.[119]

G. Sony

202. Sony Corporation is a Japanese corporation engaged in manufacturing of consumer audio and video products, semiconductors and electronic components. The first commercial lithium-ion battery was introduced by Sony in 1991.[120] The Energy Business Group is the business group primarily responsible for Sony's lithium ion battery business, and its battery business was broadly organized into two divisions depending on end applications during the Class Period.[121]

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[116] "Corporate History," Panasonic Corporation, http://www.panasonic.com/global/corporate/history/chronicle.html.

[117] Paul Milligan, "SANYO NAME TO CEASE BY APRIL 1, 2012, PANSONIC TELLS PARTNERS," AV Magazine, November 29, 2011.

[118] Kouji Kariatsumari, "Sanyo, GS Yuasa to Liquidate Li-ion Battery JV," Nikkei Electronics, August 23, 2010.

[119] Supplemental Objections and Responses of Defendants Sanyo Electric Co., Ltd. And Sanyo North America Corporation to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories, April 17, 2015, 2.

[120] "Charge your Emotion," Sony Corporation, http://www.sony.net/SonyInfo/csr/SonyEnvironment/ChargeyourEmotion.html.

[121] Sony Corporation's and Sony Energy Devices Corporation's Supplemental Responses and Objections to Direct and Indirect Purchaser Plantiff's First Set of Interrogatories to Defendants, April 14, 2015, 11

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203. Sony Energy Devices Corporation ("SEND") is a manufacturing subsidiary in Japan and operates facilities for lithium ion batteries and battery packs in Japan, and Sony Corp. owns additional manufacturing facilities in P.R.C. and Singapore.

H. Toshiba

204. Toshiba Corporation, a Japanese corporation, is a multinational manufacturer of a wide range of electric and electronic products.[122] Toshiba manufactured lithium ion batteries and battery products through its subsidiary A&T Battery Corporation. Toshiba created the Battery & Energy Division in 2001. [123] Toshiba withdraw from the lithium ion battery business in 2004.[124]

205. Toshiba America Electronic Components, Inc. ("TAEC") is a wholly-owned subsidiary of Toshiba America, Inc., which is in turn a wholly-owned American subsidiary of Toshiba Corp. TAEC was established in March 1989[125] and was the exclusive distributor of Toshiba-manufactured lithium ion batteries and battery products to customers located in the U.S.A. until Toshiba exited the lithium ion battery business in 2004.[126]

206. Battery Pack of America Inc. ("BPA") and Battery Pack of China ("BPC") were subsidiaries of Toshiba Battery Co. Ltd. that manufactured lithium ion battery packs during the Class Period.[127]

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[122] "Business Domains," Toshiba Corporation, https://www.toshiba.co.jp/worldwide/about/company/index.html.

[123] Toshiba Corporation's Supplemental Objections and Responses to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories to Defendants, April 16, 2015, 7 ("Toshiba Supplemental Responses to 1st Rogs").

[124] Toshiba Supplemental Responses to 1st Rogs, 8.

[125] "Company Overview," Toshiba Corporation, http://toshiba.semicon-storage.com/us/company/taec/company-overview.html.

[126] Toshiba Supplemental Responses to 1st Rogs, 8.

[127] Toshiba Supplemental Responses to 1st Rogs, 8-9.

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EXHIBIT 1

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January 22, 2016

CURRICULUM VITAE

Edward E. Leamer

Position: Chauncey J. Medberry Chair in Management
Professor of Statistics
Professor of Economics
Director, Business Forecast Project

Address: Anderson Graduate School of Management
University of California
110 Westwood Plaza
Los Angeles, California 90095-1481

Phone: (310) 206-1452

FAX: (310) 825-4011

E-Mail: edward.leamer@anderson.ucla.edu

Birth: May 24, 1944

Education: B.A., Princeton, 1966, mathematics
M.A., University of Michigan, mathematics(statistics)
Ph.D., University of Michigan, 1970, economics

Honors: Society of Sigma Xi
Fellow, Econometric Society
Fellow, American Academy of Arts and Sciences
New Horizons in Economic Thought, Appraisals of Leading Economists, ed. by Warren J. Samuels, chapter by Herman Leonard and Keith Maskus, 1992.
Graham Lecture, Princeton University, March 1994.
Christie Lecture, Millersville University, October 1998.
Who's Who in Economics, edited by Mark Blaug, Edward Elgar
Fathauer Lecture, University of Arizona, 2013
Citibank Teaching Award, 2001
EMBA Teaching Award: 2001, 2002, 2010
Outstanding Antitrust Litigation Achievement in Economics, Re High-Tech Employee Antitrust Litigation, American Antitrust Institute, 2014
Prize in my name: Leamer-Rosenthal Prize, Berkeley Institute for Transparency in the Social Sciences.

Academic Appointments:

Assistant Professor:
- Wayne State University, January-June, 1970
- Harvard University, July, 1970-June, 1973

Associate Professor:
- Harvard University, July, 1973-June, 1975

Professor of Economics:
- University of California at Los Angeles, July 1975-

Chauncey J. Medberry Chair in Management:
- Anderson Graduate School of Management, July 1990-

Professor of Statistics
- University of California at Los Angeles, July 1997-

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Administrative Positions:

Chairman, Department of Economics:
University of California, Los Angeles, 1983-87.
Area Head, Business Economics:
Anderson Graduate School of Management, 1990-92, 1994-6
Director, UCLA/Anderson Business Forecast, July 2000 -

Visiting Positions:

Visiting Professor:
University of Southern California, 1979-80
University of Basel, June 1990.
Central European University, April 1993.
Graduate School of Business, University of Chicago, Fall 1994
Yale University, 1995
Universidad de San Andreas, Argentina, 1997
University of Oregon, 2001
Gastprofessor:
Institute for Advanced Studies, Vienna, October 1987, June 1991, July 1992, April 1993, June 1995
Visiting Scholar:
Federal Reserve Board, March 1988, September 1989, September 1991, September 1993, May 1996
International Monetary Fund, 1992, 1993.
Lecturer, National Science Council, Republic of China, Dec. 1991.
United States Study Center, University of Sydney, 2009
Visiting Fellowship:
Department of Statistics (Econometrics), The Australian National University, August-September, 1988
Research Fellow:
National Bureau of Economic Research, 1989-.
Lecturer:
Dutch Network for Quantitative Economics, May 1990.

Fellowships, Grants:

NSF graduate traineeship, 1966-67
NDEA Fellowship, 1967-70
National Science Foundation Grant GS31929, Bayesian Inference with Economic Data,
U.S. State Department, 1970-71, "Tariffs and the Commodity Composition of Trade," with R.M. Stern, University of Michigan
Federal Reserve, Board of Governors, 1971-72, "Controlling Monetary Aggregates"
Department of Labor, 1974-75, "Tariffs and the Allocation of Labor"
National Science Foundation Grant, SOC 76-08863, 1976-78
Ford Foundation Grant, "The Commodity Composition of Trade," 1977-79
National Science Foundation, SOC 78-09477, 1978- 80, "Bayesian Statistical Search and Estimation Procedures"
Department of Labor, "Trade and Employment," 1978-79
National Science Foundation, renewal, 1980-82, 1982-84, 1984-86, 1986-7
World Bank, "Effects of Non-tariff Barriers", 1986-87.
National Science Foundation, "Determinants of the Real Exchange Rate", with Sebastian Edwards, 1986-7
Sloan Foundation, "Empirical Studies of the Effect of U.S. International Economic Policy on the Distribution of Income", 1987-93
National Science Foundation, "Bayesian Elicitation Diagnostics," 1989-91.
Labor Department, "Estimates of the Effects of Non-tariff Barriers", 1989-90.
National Science Foundation, "Economic Integration of High-wage and Low-wage Economies," 1992-4, 1994-96.
Chiang Ching-Kuo Foundation for International Scholarly Exchange, "Economic Integration of Taiwan with Mainland China," with Ivan Pn'g, 1993-4.
Price Waterhouse, "Does U.S. Foreign Direct Investment Reduce Domestic Investment?", 1993-4.

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Sage Foundation, “Trade and US Wages,” 1997-2000.
Minimum Wages in Los Angeles, the Arnold Foundation, 2015-2017.

Professional Activities:

Global Fellow, UCLA, 2004-7

Associate Editor.
Review of Economics and Statistics, 1970-1996
Quarterly Journal of Economics, 1970-75
Journal of the American Statistical Association, 1975-1979
Econometrica, 1975-1979
Journal of International Economics, 1988-1994
Econometric Theory, 1985-1988.
Journal of Applied Econometrics, 1985-92

Editorial Board
The Journal of International Trade and Economic Development, 1995-
Asia Pacific Management Review, 2000-
The North American Journal of Economics and Finance, 2005-
*e*conomics, 2007-

Co-editor
Journal of International Economics, 1989-93

Editor
Data Point, Harvard Business Review, 2004-5.

Advisory Committee
Handbook of Applied Econometrics

Advisory Board for International Trade Abstracts,1996-

Referee
Various Journals

Outsider Reviewer
Department of Economics, University of Oregon, May 1995

National Science Foundation Panel for Evaluation of Proposals, 1976-78

Chair, L.J. Savage Memorial Prize Committee, 1979-1981

National Research Council, Committee on Basic Research in the Behavioral and Social Sciences, Working Group on Measurement and Scaling.

Frontiers of Economics, Speaker, World Bank, 1985.

National Science Foundation Panel on Empirical Studies in Economics, December 1987.

Sloan Foundation Fellowship Committee, 1988-93.

Australian Economics Congress, Invited Speaker, August 1988.

Commission on Graduate Education in Economics, American Economic Association.

Panel on Foreign Trade Statistics, National Research Council, National Academy of Sciences.

9th World Congress of the International Economics Association, Invited Speaker.

National Academy of Sciences, Speaker: "Public Policy to Maintain America's Technological Leadership," annual meeting, April 1994.

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Nominating Committee, American Economic Association, 1992-3.

Contingent Valuation Panel, National Oceanographic and Atmospheric Administration, 1992.

Councils of Economic Advisors
Governor Pete Wilson. 1995-98
Governor Arnold Schwarzenegger, 2009-11
State Comptroller, John Chiang, 2007-8
Los Angeles Mayor Garcetti, 2014-

Faculty Executive Board, Clausen Center, Haas School of Business, 1996-7

NBER
ITI summer conference organizer, 1999-2000

Bureau of Economic Analysis, Advisory Committee, 2002 –7

Queenscare
Investment Committee, 2005-
Board of Directors, 2007-11

National Academy Panel on Outsourcing, Chair, 2004-6

Los Angeles Economy and Jobs Commission, 2006-7

UCLA Extension, Board Member, 2006-

Public Outreach
Testimony at US Trade Deficit Commission of Congress, January 2000
Macarthur Working Group on Networks and Inequality, April 2000

Forecast Speaker, Multiple Locations

Teaching Experience:

Econometrics - Statistics
Bayesian Inference - Statistics
International Trade
Economic Theory
Principles of Economics
Forecasting

Dissertation: Inference with Non-Experimental Data: A Bayesian View

Publications:

Books:

Quantitative International Economics, with R.M. Stern, Boston: Allyn and Bacon, 1970.

Specification Searches: Ad Hoc Inference with Non Experimental Data, John Wiley and Sons, Inc., 1978. Translated into Spanish and Russian.

Sources of International Comparative Advantage: Theory and Evidence, Boston: MIT Press, 1984.

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Behind the Numbers: U.S. Trade in the World Economy , with Robert Baldwin and the Panel on Foreign Trade Statistics, National Research Council, Washington, D.C.: National Academy Press, 1992.

Sturdy Econometrics: Selected Essays of Edward E. Leamer, Economists of the 20th Century, Hants:Edward Elgar, 1994.

Quiet Pioneering: Robert M. Stern and His International Legacy, edited by Keith E. Maskus, Peter M. Hooper, Edward E. Leamer and J. David Richardson, Ann Arbor: The University of Michigan Press, 1997.

International Economics, Worth Series in Outstanding Contributions, edited by Edward E. Leamer, New York: Worth Publishers, 2001.

Handbook of Econometrics, Vol. 5, edited by James Heckman and Edward Leamer, 2004.

Handbook of Econometrics, Vol. 6A, edited by James Heckman and Edward Leamer, 2007.

Handbook of Econometrics, Vol. 6B, edited by James Heckman and Edward Leamer, 2007.

Macroeconomic Patterns and Stories, Springer-Verlag, 2009.

The Craft of Economics: Lessons from the Heckscher-Ohlin Framework, Ohlin Lecture, M.I.T. Press, 2012.

Tariff and Nontariff Barriers to International Trade, in process.

The Analysis of Data, in process.

NAFTA and Central America, World Bank Monograph, in process.

Who's Afraid of Global Trade? , in process.

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Op-Ed Pieces:

"Privatize Social Security? Here's Why," **LA Times,** October 2000
"Cyclically, We're Back to the Past," **LA Times**, December 4, 2000
"Is there a Real Estate Bubble?, **LA Business Journal**, June 27, 2005
"What Happens When the Housing Market Cools?" **LA Business Journal**, Jan 15, 2006
"A Dose of Urgency for Home Buyers," **New York Times**, April 2008.
"Let's Stop Paying Wall Street's Gambling Debts," with Larry Kotlikoff, **Forbes**, April 2008.
"Running a National Sale," with Larry Kotlikoff, **Financial Times**, October 2008.
"An Undergraduate Error," **National Journal**, December 2008
"What might tell us when this mess will start getting better?" **National Journal**, March 2009
"The US is NOT experiencing a second Great Depression," **National Journal**, June 2009.
"What We Need is an AAWP," **National Journal**, August 2009
"Dust-up" With Brad DeLong, **Los Angeles Times**, September 2009

Articles:

"Location Equilibria," **Journal of Regional Science**, Vol, 8 (No. 2, 1968), 229-242, reprinted in A.J. Scott, ed., Location Allocation Systems: A reader (San Francisco: Holden-Day, Inc.), forthcoming.

"Problems in the Theory and Empirical Estimation of International Capital Movements," with R.M. Stern, in F. Machlup, S. Salant and L. Tarshis, eds., **International Mobility and Movement of Capital** (National Bureau of Economic Research, New York), 1972.

"A Class of Informative Priors and Distributed Lag Analysis," **Econometrica**, 40 (November 1972), 1059-81.

"Criteria for Evaluation of Econometric Models," with Phoebus Dhrymes and others, **Annals of Economic and Social Measurement** (July 1972), 259-290.

"False Models and Post-Data Model Construction," **Journal of the American Statistical Association**, 69 (March 1974), 122-131; abstracted in **Zentralblatt fur Mathematik,** reprinted in Omar F. Hamouda and J.C.R. Rowley, **Foundations of Probability, Econometrics and Economic Games,** Edward Elgar Publishing Limited, 1995.

"Empirically-weighted Price and Income Indexes for Import Demand Functions," **Review of Economics and Statistics**, LV (November 1973), 441-450.

"Multicollinearity: A Bayesian Interpretation," **Review of Economics and Statistics**, LV (August 1973), 371-380.

"Nominal Tariff Averages with Estimated Weights," **Southern Economic Journal** (July 1974), 34-46.

"The Commodity Composition of International Trade: An Empirical Analysis," **Oxford Economic Papers**, 26 (November 1974), 350-374.

"A Bayesian Interpretation of Pretesting," with G. Chamberlain, **Journal of the Royal Statistical Society**, Series B, 38 (No. 1, 1976), 85-94.

"Explaining Your results' as Access-Biased Memory," **Journal of the American Statistical Association** (March 1975), 88-83.

"Tariffs in a Trade-Dependence Model," in H. Glejser, ed., **Quantitative Studies of International Economic Relations** (North-Holland Publishing Co., Amsterdam), 1976.

"A Result on the Sign of Restricted Least Squares Estimates," **Journal of Econometrics**, 3 (1975), 387-390.

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"Matrix Weighted Averages and Posterior Bounds," with G. Chamberlain, **Journal of the Royal Statistical Society**, Series B, 38 (No. 1 1976), 73-84.

"An Empirical Analysis of the Composition of Manufacturing Employment in the Industrialized Countries," with R.M. Stern and C.F. Baum, **European Economic Review**, 9 (1977), 1-19.

"Regression Selection Strategies and Revealed Priors," **Journal of the American Statistical Association** (September 1978), 580-587.

"Least Squares Versus Instrumental Variables Estimation in a Simple Errors in Variables Model," **Econometrica** (July 1978), 961-968.

"The Information Criterion for the Choice of Regression Models, A Comment," **Econometrica** (March 1979), 507-510.

"Difficulties with Testing for Causation," with R. Jacobs and M. Ward, **Economic Inquiry** (July 1979), 401-13.

"The Leontief Paradox, Reconsidered," **Journal of Political Economy** (June 1980), 495-503; reprinted in J. Bhagwati, ed., **International Trade: Selected Readings**, Cambridge: MIT Press, 1986; reprinted in J. Peter Neary, ed., International Trade: The International Library of Critical Writings in Economics, Edward Elgar, forthcoming, 1994; reprinted in Heinz D. Kruz and Christian Lager, **Input-Output Analysis**, Edward Elgar Publishing Limited, 1997; reprinted in Edward E. Leamer, **International Economics**, Worth Publishers, 2001.

"Sets of Estimates of Location," **Econometrica**, Vol. 49, No. 1 (January 1981), 193-204.

"Welfare Computations and the Optimal Staging of Tariff Reductions in Models with Adjustment Costs," **Journal of International Economics**, 10 (1980), 21-36.

"Cross-Section Tests of the Heckscher-Ohlin Theorem: A Methodological Comment," with Harry P. Bowen, **American Economic Review**, 71 (December 1981), 1040-1043; reprinted in Bertil Ohlin, **Critical Assessments of Leading Economists**, Routledge, 1996

"Is It a Supply Curve, or Is It a Demand Curve: Partial Identification through Inequality Constraints," **Review of Economics and Statistics**, Vol. LXIII, No. 3 (August 1981), 319-327.

"Parameterization-free Ridge Regression Bounds," **Journal of the American Statistical Association**, 76 (December 1981), 842-849.

"The Hit Parade of Economics Articles," in E. Tower, editor, **Economics Reading Lists, Course Outlines, Exams, Puzzles and Problems**, Volume 14, July 1981.

"Sets of Posterior Means with Bounded Variance Priors," **Econometrica**, 50 (May 1982), 725-736.

"Comment on `Specification Analysis with Discriminating Priors'," by Thomas F. Cooley, **Econometric Reviews**, First Issue, 1982.

"Techniques for Estimation with Incomplete Assumptions," **Proceedings of IEEE Meeting on Decision and Control**, San Diego, December 1981.

"Robust Sets of Estimates for Regression," with C.Z. Gilstein, **Econometrica**, LXV (May 1983), 306-317.

"Let's Take the Con Out of Econometrics," **American Economics Review**, 73 (March 1983), 31-43; reprinted in Bruce J. Caldwell, Criticism and Appraisal in Economics: A Book of Readings (Allen and Unwin, 1985); reprinted in Thomas J. Coyne, **Readings in Managerial Economics**, 1985; excerpted in Caroline P. Clotfelter, **Economic Satire: Wit and Humor in the Dismal Science**, Armonk, New York: M.E. Sharpe; summarized in **Journal of Forecasting**, reprinted in C.W.J. Granger,ed., **Modeling Economic Series**, Oxford: Oxford University Press, 1990; reprinted in Dale J. Poirier, **The Methodology of Econometrics II**, Hants: U.K.: Edward Elgar, 1994;

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reprinted in Omar F. Hamouda and J.C.R. Rowley, **Foundations of Probability, Econometrics and Economic Games**, 1996; reprinted in Guy Peters**, The International Library of Comparative Public Policy - Series B**., 1996; reprinted in Andrew Lo, **Financial Econometrics**, 2006.

"Reporting the Fragility of Regression Estimates," with H. Leonard, **Review of Economics and Statistics**, LXV (May 1983), 306-3417.

"Model Choice and Specification Analysis," in Z. Griliches and M. Intriligator, eds., **Handbook of Econometrics, Volume 1**, Amsterdam: North Holland, 1983.

"Sets of Weighted Regressions" (with C.Z. Gilstein), **Journal of the American Statistical Association**, 78 (December 1983), 942-948.

"Consistent Sets of Estimates for Regression with All Variables Measured with Error" (with S. Klepper), **Econometrica**, 52 (January 1984), 163-183.

"Vector Autoregressions for Causal Inference?", in Karl Brunner and Allan H. Meltzer, eds., **Carnegie-Rochester Conference Series On Public Policy: Understanding Monetary Regimes**, Volume 22, 1985, 255-304; reprinted in Kevin D. Hoover, ed., **The New Classical Macroeconomics**, The University of California Press at Davis, 1992; reprinted in Dale J. Poirier, **The Methodology of Econometrics II**, Hants, England: Edward Elgar, 1994.

"Global Sensitivity Analysis for Generalized Least-Squares Estimates, **Journal of the American Statistical Association**, 79 (December 1984), 867-870.

"Bayesian Regression and Sensitivity Analysis," **Multiple Regression Analysis: Applications in the Health Sciences**," ed. by Donald E. Herbert and Raymond H. Myers, New York: American Institute of Physics, 1986.

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"Sensitivity Analyses Would Help," **American Economic Review**, Vol. 75, No. 3, June 1985, reprinted in C.W.J. Granger,ed., **Modelling Economic Series**, Oxford: Oxford University Press, 1990.

"A Bayesian Analysis of the Inflation/Unemployment Tradeoff," in David A. Belsley and Edwin Kuh, eds., **Model Reliability**, Cambridge: MIT Press, 1986, 62-89, reprinted in C.W.J. Granger,ed., **Modelling Economic Series**, Oxford: Oxford University Press, 1990.

"Nonexperimental Inference," in S. Kotz and N.L. Johnson, eds., **Encyclopedia of Statistical Sciences**, vol. 6, New York: John Wiley and Sons, 1985.

"Leontief Paradox," in **The New Palgrave: A Dictionary of Economics**, edited by John Eatwell, Murray Migate and Peter Newman, London: The Macmillan Press, 1987.

"Specification Problems in Econometrics," in **The New Palgrave: A Dictionary of Economics**, edited by John Eatwell, Murray Migate and Peter Newman, London: The Macmillan Press, 1987.

"Self Interpretation," **Economics and Philosophy**, (1, 1985), 295-302; abstracted in The Philosopher's Index.

"Econometric Metaphors," in T. Bewley, ed., **Advances in Econometrics, Fifth World Congress**, Cambridge: Cambridge U. Press, 1987.

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"Cross Section Estimation of the Effects of Trade Barriers," in R. Feenstra, ed., **Empirical Methods for International Trade**, Cambridge: MIT Press, 1987, 52-82.

"Multi-country Multi-factor Tests of the Factor Abundance Theory," with H.P. Bowen and L. Sveikauskus, **American Economic Review**, 77, no. 5, December 1987, 791 - 809; reprinted in Peter Neary, ed., **International Trade: The International Library of Critical Writings in Economics**, London: Edward Elgar Publishing, Ltd.; reprinted in Edward E. Leamer, **International Economics**, Worth Publishers, 2001; reprinted in Danel M. Bernhofen**, Empirical International Trade**, 2009.

"Empirical Tests of Alternative Models of International Growth," with L. Kotlikoff, in Colin I. Bradford and William H. Branson, eds., **Trade and Structural Change in Pacific Asia**, Chicago: University of Chicago Press, 1987, 227 - 269.

"Paths of Development in the Three-Good n-Factor General Equilibrium Model," **Journal of Political Economy**, Vol. 95, No. 5, October, 1987, 961-999.

"Errors-in-Variables in Linear Systems," **Econometrica**, Vol. 55, No. 4, July, 1987, 893 -909.

"The Sensitivity of International Comparisons of Capital Stock Measures to Different 'Real Exchange Rates", **American Economic Review, Papers and Proceedings,** May 1988, 78, No. 2, 479 - 483.

"Measures of Openness" in R. Baldwin, ed., **Trade Policy Issues and Empirical Analysis**, University of Chicago Press, 1989, 147-200.

"Causality", discussion papers by Paul W. Holland, in Clifford C.Clogg, ed., **Sociological Methodology**, 1988, 485- 493.

"Things That Bother Me," **Proceedings from the 1988 Australian Economics Congress,** Michael McAleer and Ric Simes, eds., **Economic Record**, 64, (December 1989), 331-335.

"Optimal Aggregation of Linear Net Export Systems," in Terry Barker and M. Hashem Pesaran, eds., **Disaggregation in Econometric Modelling**, London: Routledge, 1990, 150-170.

"Planning, Criticism and Revision," in Michael McAleer, ed., **Topics in Applied Econometrics, Journal of Applied Econometrics**, Vol. 4S, (December 1989), S5-S28.

"The Structure and Effects of Tariff and Nontariff Barriers in 1983," in Anne P. Krueger and Ronald Jones, eds. **Festschrift** for Robert Baldwin, Basil Blackwell, 1990, 224-260.

"Latin America as a Target of Trade Barriers Erected by the Major Developed Countries in 1983," **Journal of Development Economics**, 32 (1990), 337-368.

> Reprinted as "La America Latina como un objectivo de las barreras comerciales erigidas por los principales paises desarrollados en 1983," **El Trimestre Economico**, Vol LVII (Diciembre 1990), 103-140.

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"A Conversation on Econometric Methodology," with Dale Poirier and David Hendry, **Journal of Econometric Theory**, 6, No. 2, June 1990, pp. 171-261; reprinted in Dale J. Poirier, ed., **The Methodology of Econometrics**, forthcoming, 1994.

"Comment" on Keith Maskus, "Comparing International Trade Data and Product and National Characteristics Data for the Analysis of Trade Models," in Peter Hooper and J. David Richardson, eds., **International Economic Transactions: Issues in Measurement and Empirical Research**, Chicago: University of Chicago Press, 1991, pp.56-60.

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"A Bayesian Perspective on Inference from Macro-Economic Data," **Scandanavian Journal of Economics: New Approaches to Empirical Research in Macroeconomics**, Vol. 93, No. 2, 1991, pp. 225-248; reprinted in Omar F. Hamouda and J.C.R. Rowley, **Foundations of Probability, Econometrics and Economic Games**, 1996.

Comment on "Has Formalisation in Economics Gone Too Far?", **Methodus**, Vol. 3, No.1, (June 1991), 25-26; reprinted in Craig Freedman, ed., forthcoming.

"Report of the Commission on Graduate Education in Economics" with Anne Krueger et. al., **Journal of Economic Literature**, XXIX, (September 1991), 1035-1053.

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2012-2014

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2011

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Expert Report, May 2011
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2009

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Settlement
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Damages from Patent Infringement
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2008-2012

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2007

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FRAND royalty rates
Consultation
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2006

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Effect on copper prices
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Sampling methods

2005

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Sampling methods for estimating bad debt fraction
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2004

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2003

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    Expert Report
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2002

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Reliability of End Play Checks
Expert Report
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Economic Value of Lithium Ion Battery in Dell notebooks
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Settlement

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Settlement

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Plaintiffs: Ernest Schatz and Benjamin Kaye
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2001

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Expert report regarding estimation of but-for Canadian stumpage values
Testimony at Commerce Department hearing, March 5, 2002

2000

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Respondents:
China National Offshore Oil Corporation
ARCO China Incorporated
KUFPEC (China) Incorporated
Gas Dewpoints by Dewscopes and Gas Chromotography
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But-for revenue streams from ad placements
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1999

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Expert Report
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Settlement

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EXHIBIT 3

Corrected Exhibit 3
List of Materials Relied Upon

Pleadings and Orders	**Date**
Defendant Hitachi Maxell, Ltd.'s Amended Objections and Responses to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories	04/03/15
Indirect Purchaser Plaintiffs' Third Consolidated Amended Class Action Complaint	10/22/14
NEC Corporation's Supplemental Objections and Responses to Plaintiffs' First Set of Interrogatories	03/31/15
Objections and Responses of Defendant Panasonic Corporation to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories	10/30/14
Samsung SDI Co., Ltd.'s Supplemental Response to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories, No. 5	01/15/16
Sony Corporation's and Sony Energy Devices Corporation's Supplemental Responses and Objections to Direct and Indirect Purchaser Plantiffs' First Set of Interrogatories to Defendants	04/14/15
Supplemental Objections and Responses of Defendants Panasonic Corporation and Panasonic Corporation of North America to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories	04/28/15
Supplemental Objections and Responses of Defendants Sanyo Electric Co., Ltd. And Sanyo North America Corporation to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories	04/28/15
Toshiba Corporation's Supplemental Objections and Responses to Direct and Indirect Purchaser Plaintiffs' First Set of Interrogatories to Defendants	04/16/15

Correspondence	**Date**
Hitachi - Maxell	
Letter from Jessica Spradling Russell to Aaron Sheanin	07/24/15
Letter from Jessica Spradling Russell to Marc A. Pilotin	09/11/15
Letter from Jessica Spradling Russell to Aaron Sheanin and Marc Pilotin	09/21/15
Letter from Jessica Spradling Russell to Aaron Sheanin and Marc Pilotin	09/28/15
Letter from Jessica Spradling Russell to Aaron Sheanin and Marc Pilotin	10/16/15
MAXELL Product Code Reconciliation.pdf	
LG Chem	

2/2/2016

Corrected Exhibit 3
List of Materials Relied Upon

Letter from Mollie McGowan Lemberg to Aaron Sheanin, Lin Chan and Marc Pilotin	10/09/15
Letter from Mollie McGowan Lemberg to Shana Scarlett	12/15/15

Exhibits

Letter from Mollie McGowan Lemberg (Exhibit B)	09/02/15
Letter from Mollie McGowan Lemberg (Exhibit A)	09/28/15
Letter from Mollie McGowan Lemberg (Exhibit A)	10/09/15
Letter from Mollie McGowan Lemberg (Exhibit A)	12/15/15

Panasonic - Sanyo

Letter from Aaron M. Sheanin to Jeffrey J. Amato	05/27/15
Letter from Aaron M. Sheanin to Jeffrey J. Amato and Roxann E. Henry	07/23/15
Letter from Jeffrey J. Amato to Aaron M. Sheanin	09/04/15
Letter from Jeffrey J. Amato to Aaron M. Sheanin and Lin Chan	09/04/15
Letter from Jeffrey J. Amato to Marc A. Pilotin (re Panasonic)	09/21/15
Letter from Jeffrey J. Amato to Marc A. Pilotin (re Sanyo)	09/21/15
Letter from Jeffrey J. Amato to Aaron M. Sheanin	10/22/15

Samsung

Letter from Michael W. Scarborough to Aaron M. Sheanin and Lin Y. Chan	07/31/15
Letter from Dylan I. Ballard to Aaron M. Sheanin and Lin Y. Chan	08/28/15
Letter from Michael W. Scarborough to Aaron M. Sheanin and Lin Y. Chan	12/23/15
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Letter from Heather T. Rankie to Beatriz Mejia and Jon Cieslak	04/07/15
Letter from Jon Cieslak to Heather T. Rankie	04/10/15

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Letter from Heather T. Rankie to Beatriz Mejia and Jon Cieslak (re Material Cost Data)	09/08/15
Letter from Heather T. Rankie to Beatriz Mejia and Jon Cieslak (re Transactional Data)	09/08/15
Letter from Marc A. Pilotion to Beatriz Mejia and Jon Cieslak	09/09/15

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Letter from J. Frank Hogue to Aaron M. Sheanin	10/07/15
Letter from J. Frank Hogue to Marc A. Pilotin	10/07/15
Letter from J. Frank Hogue to Aaron M. Sheanin	10/09/15

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Letter from J. Frank Hogue (Exhibit A)	10/07/15
Letter from J. Frank Hogue (Attachment "A")	10/09/15

Others

Email from Angela J.Yu to Shana Scarlett	09/18/15
Email from Lindsay Sklar Johnson to Shana Scarlett	12/23/15
Email from Mark W. Haase to Shana Scarlett	06/25/15
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https://www.cdw.com/shop/products/Spectralink-Link-6020-Wireless-Telephone/1008698.aspx
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Documents

Hitachi-Maxell

HML-P-015965	-	HML-P-016002
HML-P-076854	-	HML-P-076856

LG Chem

LGC-MDL-0000770	-	LGC-MDL0000805
LGC-MDL0098436	-	LGC-MDL0098473
LGC-MDL0098654		
LGC-MDL0239585	-	LGC-MDL0239609
LGC-MDL0299622	-	LGC-MDL0299646
LGC-MDL0643671		

Panasonic - Sanyo

PNA0063173		
SANYO0136494	-	SANYO0136524

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List of Materials Relied Upon

SANYO0438644
SANYO0000159
SANYO0000160
SANYO-C000037345
SANYO-C000154182 - SANYO-C000154210
SANYO-C000300077
SANYO-C000625107

Samsung

SDI-B-000004904PCT - SDI-B-000004925
SDI-B-000039415 - SDI-B-000039431

SONY

SONY-LIB-000476464 - SONY-LIB-000476485
SONY-LIB-000820615
SONY-LIB-000893992

Other (Exhibits)

Exhibit 504E
Exhibit 617
Exhibit 715E
Exhibit 1104E
Exhibit 1109E
Exhibit 1110E
Exhibit 1111E
Exhibit 1127
Exhibit 1148E

Data

Battery Sales

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List of Materials Relied Upon

<u>Hitachi-Maxell</u>

HML-P-000001
MAX-P-010645
MAX-P-010646
MAX-P-010647
MAX-P-010648
MAX-P-010649

<u>LG Chem</u>

LGC_MDL0002340
LGC_MDL0002341
LGC_MDL0002364
LGC_MDL0002365
LGC_MDL0002366
LGC_MDL0002367
LGC_MDL0002368
LGC_MDL0005404
LGC_MDL0005405

<u>Panasonic</u>

PANA0000060 - PANA0000075
PANA0000076
PANA0000085 - PANA0000089
PANA0000091 - PANA0000092
PANA0000093 - PANA0000635
PANA0000638 - PANA0000640
PANA0000647 - PANA0000652
PNA0000001
PNA0000002

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PNA0000025

Sanyo

SANYO0000156
SANYO0000157
SANYO0000158
SANYO0000161
SANYO0000162
SANYO0000163
SANYO0000245

Samsung

SDI_B_000007123
SDI_B_000017535
SDI_B_000017536

SONY

SONY_0001
SONY_0002
SONY_0003
SONY_0004
SONY_0005
SONY_0006
SONY_0007
SONY_0008
SONY_0009
SONY_0010
SONY_0011
SONY_0012

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List of Materials Relied Upon

SONY_0013
SONY_0014

<u>Toshiba</u>

TSBLIB00000001
TSBLIB00000002
TSBLIB00000003
TSBLIB00000004
TSBLIB00000005
TSBLIB00000006
TSBLIB00000079
TSBLIB00000087
TSBLIB00000088
TSBLIB00000089

Battery Product Sales

<u>SONY</u>

SONY_LIB_DATA_18032 - SONY_LIB_DATA_18059
SONY_LIB_DATA_18079 - SONY_LIB_DATA_18108
SONY_LIB_DATA_18126 - SONY_LIB_DATA_18134
SONY_LIB_DATA_18152 - SONY_LIB_DATA_18161
SONY_LIB_DATA_18185 - SONY_LIB_DATA_18212
SONY_LIB_DATA_25359 - SONY_LIB_DATA_25366

<u>Toshiba</u>

TSB-LIB-00000080
TSB-LIB-00000083
TSB-LIB-00000084
TSB-LIB-00000085

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Product Specifications

Hitachi-Maxell

HML-P-013337
MAX-P-046298
MAX-P-256595
SANYO-C000200767
TSB-LIB-00016745

LG Chem

LGC-MDL0094774
LGC-MDL0103143
LGC-MDL0109835
LGC-MDL0161386
LGC-MDL0166154
LGC-MDL0179110
LGC-MDL0179119
LGC-MDL0185372
LGC-MDL0225512
LGC-MDL0227225
LGC-MDL0316274
LGC-MDL0339552
LGC-MDL0340448
LGC-MDL0340577
LGC-MDL0342629
LGC-MDL0349236
LGC-MDL0598322

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http://www.sot.com.tw/images/06.pdf
http://www.sot.com.tw/images/140213_LGChem_Roadmap('14%201Q)_confidential.pdf
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Panasonic

PANA-C000026758
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LGC-MDL0098436
PNA0018278
SANYO0000158

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Sanyo

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List of Materials Relied Upon

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SANYO0014672
SANYO0059828
SANYO0063153
SANYO0136494
SANYO-C000002265
SANYO-C000100278
SANYO-C000154182
SANYO-C000625107E
SONY-LIB-000332309
SONY-LIB-000477821
SONY-LIB-000820615

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Samsung

SDI-B-000032921
SDI-B-000032937
SDI-B-000032985
SDI-B-000032988
SDI-B-000033041
SDI-B-000035640
SDI-B-000038022
SDI-B-000042391
SDI-B-000042412

Corrected Exhibit 3
List of Materials Relied Upon

SDI-B-000043356
SDI-B-000083306

SONY

SANYO0340173
SANYO-C000109187
SONY-LIB-000067023
SONY-LIB-000089681
SONY-LIB-000408451
SONY-LIB-000421786
SONY-LIB-000422318
SONY-LIB-000424838
SONY-LIB-000426419
SONY-LIB-000426550
SONY-LIB-000426823
SONY-LIB-000427354
SONY-LIB-000428094
SONY-LIB-000428616
SONY-LIB-000431107
SONY-LIB-000432605
SONY-LIB-000434474
SONY-LIB-000441542
SONY-LIB-000442999
SONY-LIB-000443848
SONY-LIB-000445384
SONY-LIB-000445905
SONY-LIB-000447588
SONY-LIB-000452943
SONY-LIB-000452960
SONY-LIB-000454141
SONY-LIB-000455068
SONY-LIB-000455256
SONY-LIB-000455680
SONY-LIB-000469387

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SONY-LIB-000470612
SONY-LIB-000473448
SONY-LIB-000473735
SONY-LIB-000820615

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Toshiba

TSB-LIB-00149712
TSB-LIB-00001601
TSB-LIB-00165389
TSB-LIB-00134108

Third Party Data

ABC Ware House

ABCW-00247372
ABCW-00247373
ABCW-00344180

Ace Hardware

Copy of battery export until 5 31 2015.xlsx
Copy of Lithium Battery Tools.xlsx
Lithium battery tools 6 years POS through 8.24.2015.xlsx

Acer

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List of Materials Relied Upon

ACER-IPP-0000001 CR
ACER-IPP-0000002 CR
ACER-IPP-0000007 CR

Amazon

2015-09-24 Amazon HIGHLY CONFIDENTIAL DocProd (to LCD prod'd 8.28.08).xls

Aopen

AOPEN_BATTERIES_0001 - AOPEN_BATTERIES_0066
AOPEN_BATTERIES_0067 - AOPEN_BATTERIES_0127

ASI

Notebooks ASI.csv
PO INNB 2000_2011-05.csv

BestBuy

BBY_LIB0000004
BBY_LIB0000005
BBY_LIB0000006

Black&Decker

SBD_BDUS-000001

CDW

CDW Customer Sales - Lithium Ion Battery Products 2009.csv
CDW Customer Sales - Lithium Ion Battery Products 2011.xlsx
CDW Customer Sales - Lithium Ion Battery Sales 2010.xlsx
CDW Purchase History - Lithium Ion Products 2009.csv
CDW Purchase History - Lithium Ion Products 2010-2011.xlsx

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List of Materials Relied Upon

Dell

DELL_LIBSALES_00047 - DELL_LIBSALES_00214

Fujitsu

FAI HIGHLY CONFIDENTIAL Accessory and Unit Battery Shipment 2001.xls
FAI HIGHLY CONFIDENTIAL Accessory and Unit Battery Shipment 2002.xls
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FAI HIGHLY CONFIDENTIAL Accessory and Unit Battery Shipment 2005.xls
FAI HIGHLY CONFIDENTIAL Accessory and Unit Battery Shipment 2006.xls
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FAI HIGHLY CONFIDENTIAL Accessory and Unit Battery Shipment 2010.xlsx
FAI HIGHLY CONFIDENTIAL Accessory and Unit Battery Shipment 2011.xlsx

Home Depot

HOMEDEPOT000002
Epiphani_Data_Product_List.xlsx

Ingram

BATTERIES-INGRAM00000050
BATTERIES-INGRAM00000051
BATTERIES-INGRAM00000052
BATTERIES-INGRAM00000053
BATTERIES-INGRAM00000054
BATTERIES-INGRAM00000055
BATTERIES-INGRAM00000056

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BATTERIES-INGRAM00000057
BATTERIES-INGRAM00000058
BATTERIES-INGRAM00000059
BATTERIES-INGRAM00000060
BATTERIES-INGRAM00000061
BATTERIES-INGRAM00000062
BATTERIES-INGRAM00000063
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BATTERIES-INGRAM00000078
BATTERIES-INGRAM00000079
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BATTERIES-INGRAM00000081
BATTERIES-INGRAM00000082

MEI

LithIon2008 Highly Confidential.csv
LithIon2009 Highly Confidential.csv
LithIon2010 Highly Confidential.csv
LithIon2011 Highly Confidential.csv

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PC Connection

Lithium Battery Products - ODD Sales Out 2 2004.xlsx
Lithium Battery Products - ODD Sales Out 2 2005.xlsx
Lithium Battery Products - ODD Sales Out 2 2006.xlsx
Lithium Battery Products - ODD Sales Out 2 2007.xlsx
Lithium Battery Products - ODD Sales Out 2 2008.xlsx
Lithium Battery Products - ODD Sales Out 2 2009.xlsx
Lithium Battery Products - ODD Sales Out 2004-2009.xlsx
Lithium Battery Products - Sales Out 2000-2003.xlsx
Lithium Battery Products - Sales Out 2004-2009.xlsx
Lithium Battery Products - Sales Out 2010-2012.xlsx

PCM

Subpoena 2015.xlsx

SED International

SED000002

Other

LG Chem

LGC-MDL0002342
LGC-MDL0239585

Panasonic

PANA-C000076205
P-DOJ0099116

Samsung

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Samsung_000017539 - Samsung_000017540

SONY

SONY-LIB-000332309
SONY-LIB-000893992

Display Search, DS_2011Q2_Econ One Custom Project_Revised.xls
Product specifications.xls

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Federal Reserve Bank of St. Louis, Producer Price Index by Industry , https://research.stlouisfed.org/fred2
Federal Reserve Bank of St. Louis, Producer Price Index for All Commodities, https://research.stlouisfed.org/fred2/series/PPIACO
Federal Reserve Bank, Exchange Rates
USForex Inc, Historical Exchange Rates
USGS, Minerals, minerals.usgs.gov
US Census Bureau, New Residential Construction